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Centimeter

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 mm

1 2 3 4 5

Inches

Thomas A. Edison Papers

A SELECTIVE MICROFILM EDITION

PART II
(1879–1886)

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START

37

A Note on the Sources

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THOMAS A. EDISON PAPERS

A SELECTIVE MICROFILM EDITION
PART II
(1879-1886)

REEL 37

NOTEBOOK SERIES (NBK-15)

Menlo Park Notebooks, #114 - #127

Menlo Park Notebook #114 [N-80-08-10]

This notebook covers the period August 1880-January 1881. The entries are by Francis Upton. The book contains calculations, along with occasional notes and drawings, relating to tests of dynamos and motors. There are also a few notes and calculations relating to lamps, meters, and tests of German silver wire. The label on the front cover is marked "Upton," "Motors," and "Machines." The book contains 284 numbered pages.

Blank pages not filmed: 2-3, 8-15, 18-19, 172-173, 206-275, 284.

Aug 10-80

Old paper loop after burning a long time measured on face 0.063 sq. in as the surface of one face

0".021 wide

3" long

Let r = resistance machine constant
& R = " " " outside variable

$\mathcal{E}$ = E.M.F transmitter constant

$\mathcal{E}''$ = " " " motor variable

$\mathcal{E}' = \mathcal{E} - \mathcal{E}''$

W = work outside

w = work internal

C = current

W'' = work from motor

$$W = KC\mathcal{E}'' + K\mathcal{E}\mathcal{E}' - KC^2 r$$

$$= KC\mathcal{E} - KC^2 r$$

$$C = \frac{\mathcal{E}'}{R+r} = \frac{\mathcal{E} - \mathcal{E}''}{R+r}$$

$$W = \frac{K(\mathcal{E}-\mathcal{E}'')\mathcal{E}}{R+r} - \frac{K(\mathcal{E}-\mathcal{E}'')^2 r}{(R+r)^2}$$

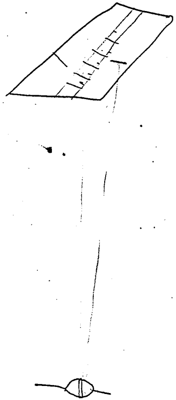
$$W''_0 = KC\mathcal{E}''$$

$n = \frac{W}{w}$ constant

$l = \frac{R}{r}$ variable

$\mathcal{E} = C(R + r) + \mathcal{E}''$

$W = C(\mathcal{E}' + \mathcal{E}'') - C^2 r$



Estimate for 13 H. P. machine [illegible] dynamo to run 600 revs direct

Present machine 10 inches by 10 inches

75 commutators

7 per H. P.

$$\frac{33000 \text{ ft. lbs}}{} = \frac{E^2}{R} \times \cancel{66}4.3$$

$$7 \big) \frac{33000}{4743} = \frac{E^2}{100} \times 44.3$$

$$E^2 = \frac{474300}{44.3}$$

516758
1.6464
4.0294
2.0147

105 Volts required of machine

Stegmer machine

Mr. Edison wants 30 to 23 one

Say twice the length of present machine there there will be twice the 3/2 the resistance that is $\frac{3}{16} \times .16 = .24$ Ohms resistance to give the same E.M.F.

The present machine gives 115 Volts at 1100 r.p.m. with same no. commutators to run at 600 it would give $\frac{~~2~~ 600}{1100} \times 115$

$11\overline{)690}$
62.7 Volts

Machine twice as long would give 125.4 Volts

13 H.P. machine

The present machine
has 75 X 2 = 150 turns
so to give 105 Volts in
in place of 125. Volts
there would need to
be 125 : 105 :: 150 :

2.0212
2.1761
7.9031
2.1004

@ 125 turns = 62 commutat
63 commutators

Resistance varies as square
the number of commutators
so

13 H. P. Machine

$75^2 : 63^2 :: .24 : X$

1.7993
1.7993
$\bar{1}.3802$

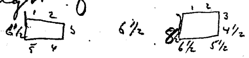
8.1249
8.1249

$\bar{1}.2286$

X = .17 Ohm

Suppose 1½ times the diameter and that the wire can be twice as thick the magnets no larger and the same strength of field.

Length of wire



13 H. P. Machine

8 : 6.5

$$\frac{8}{6.5} \times \frac{1}{2} = \frac{4}{6.5}$$

$$\frac{2}{6.5} \times .17 = \frac{.68}{6.5}$$

$\bar{1}.5315$
0.8129
$\bar{2}.7186$

~~.052~~ .002 Ohms

.75 Ohms resistance multiple are

.75 $\bar{1}.8751$
.052 $\bar{2}.7186$
1.1565

~~14.3~~ 7.3 to 1 the ratio of such a machine if wire on wider than before

13 H. P. Machine

I think the E. M. F per inch will be ~~4/3~~ 3/4 ~~of~~ of 10 in. machine the 3/4 the number of commutators will do

$1 : \frac{3}{4}^2 :: .102 : X$

since the diameter is 3/2 as great the wire will be 3/2 as wide or 2/3 the resistance of original

$1 : \frac{9}{16} \times \frac{2}{3} :: .102 : X$

$1 : \frac{2}{5} :: .102 : X$

$\frac{1}{2/5} = \frac{.102}{X} \quad X = .102 \times \frac{2}{5}$

$.204$

$X = .041$

13 H. P. machine

$\bar{1}.1565$
$\bar{2}.6128$
$\bar{2}.5437$

35 : 1 Ratio

$4 \overline{)64}$
16
3
~~4~~ 8 commutators

48 commutators

~~4~~ 8 commutator

Suppose 51 commutators

.042 $\bar{2}$.6232
2
3.2464
1764 mills

.042
17
.053
.053
.106
17
.093

93 1,9685
2
3.9370
8649

13 H.P. Machine

Present machine

8".95 on end diameter

Cutter 0".17 wide

Larger machine

9.73 inches in centre

9.50 on end

9.
3.14
29.26

1.4664
150 2.1761
$\bar{1}$.2903

0".195

.200
.159
.041 for peg

.200
.165
.035 for peg

13 H. P. Machine

9.5 0.9777
3.14 0.4971
29.87 1.4748
150 2.1761
.199 $\bar{1}$.2987

0".2 space for wire
cutter 0".17

.042
.011
.053
~~.223~~

0".159

10
9.73
.27
16
.11

Leng 0".013 Covering
.165

13 H. P. Machine

~~14" machine~~

3.14

5 3.4 1.7275

Commutator 571 1.7076

.0199

1.04 to space = 0".52

0".52

3 wires side by side

2 wire deep

0".52

.03 for vulcanized fibre

3 | 0".49

0".163

0".015

0".148

.5

16.?

13 H. P. Machine

14" machine
43.98 circum

4.398	1.6433
102	2.0086
	1.6347

.431
30 for leg
.401

.131 for covering
.013
.118
2 thick
.236

.131
2
.262

~~.737~~

.131
3
.393

.159
2
.318

3X3

See page 51 for 4 moves in notch

13 H.P. Machine

Twice as long

20" length
14" diameter
34
2
68" for ends
6
74" one turn
102 turns
148
74
4 | 7548
12 | 1887
157.2 feet of wire equals resistance of machine

1/4 resistance

O.K.

13 H. P. machine

Wire $0''$ .118 = diam

2.0719
2
4.1438

14000 mills
9 wire
126000 mills

9.718	0.9715
157.2	2.1964
Comp 126000	4.8996
	8.0671

$\bar{2}.0671$

.011 Ohms
2
.022

"13.14

Present machine

0.042

$$\begin{array}{r} 1.6232 \\ 2 \\ \hline 3.2464 \\ 6 \quad 0.7782 \\ \hline 4.0246 \end{array}$$

10500 mills

$$\begin{array}{r} 10 \\ 10 \\ \hline 20 \\ 2 \\ \hline 40 \\ 3 \\ \hline 43'' \end{array}$$

43"	1.6335
150	2.1761
comp 12	8.9208
comp 4	9.3979
	2.1283

134 feet

13. H. P. machine

	9.71	0.9872
	134	2.1271
amp	10500	5.9788
		9.0931

·124

Whereas it is ·14 Ohm

$$\frac{4\overline{)\,.55}}{.14}$$

$$\frac{30\overline{)\,75}}{.025}$$

5 0

13 ~~H.P.~~ machine

4) .401

.100
13

.087

1.9395
1.9395

3.8790

7570
8

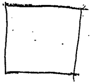
60560

0.9715
2.1964
5.2179

8.3858

24.4

.024



100 H. P. machine

Bore 20".5

Plates 20" to 19".5

2' 4" over all

100 r. p. m

gives 8 Volts on present machine.

600 would give

※ 75 turns

48 Volts

Taking this as the number of 75 turns and three times as long

$$\begin{array}{r} 48 \\ 3 \\ \hline 144 \end{array}$$ Volts

100 H.P. Machine
It is desired to obtain an average of the lamps now made

~~188~~
~~156~~
~~147~~
~~187~~
~~157~~
~~153~~
~~137~~
~~151~~
~~181~~
~~178~~
~~186~~
~~165~~
~~166~~
~~159~~
164 .15

164

2494 3.3967
1.1761
2.2206

166

100 H.P. Machine

Page 105 Ohm lamp

45970	5.8092
18470	1.2553
64440	3.5539
18	

~~4020 ft lbs~~

~~4000 ft lbs~~

4.5185
3.60
.9143

8.2 per H.P.

3420 ft lbs

4.5185
3.5539
.9646

9.2 per H.P.

100 H. P. Machine

45970
18470

64440 4.8092
18 1.2553

3.5539
3580 4.5185
.9646

9.2 ~~Ohms~~ HP per horse power

9.2 per Horse power

~~8 per H.P.~~

$$\frac{E^2}{R} 44.3 = \text{ft. lbs}$$

3.5539
2.2175
8.3536
4.1250
2.0625

115 Volts required

100 H.P. Machine

8)33.000

4125 3.6154

2.2176

8.3836

4.1865

2.0932

124 Volts 2.0932

1.0645

7.0785

3.6153

135 Volts will be

enough

~~144~~

75 : 69 :: 144 : 132

1.8388
1.1584
8.1249
_____
1.1221

144 Volts from machine
with 75 commutators

135 Volts required

144 : 135 :: 75 : 70.3

1.8751
2.1303
7.8416
_____
1.8470   70.3

71 is prime
73 is prime
75 is not

Make 69 commutators
Will give 132 Volts

100 H. P. Machine

20" on plates

20
3.14
62.80 circumference

69 commutator
2
138 divisions

1.7981
2.1399
0".455 space 9.6582

Space 0".455

100 H. P. Machine

19".5 Diameter plates

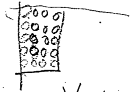
.69
2
138 divisions

19.5 1.2900
0.4969
61".2 circumf 1.7869
2.1399
9.6470

0".444 for each space

0".02 for peg
0".02 for insulation
0".05 for separation
0".394 for wire

0".394 to place wire
in side ways.



4 wire X 5 wires in space

allow 0".009 for covering
on each wire

0".036 for four wires

0".394
0".036
4) .358 X 3455
0".0895

Wire 0".09 Diameter

100 H. P. Machine

8100 circular mills
20 wires
162000 circular mills in space

Armature

29" long
20" diameter
5" Extra
54"
2
108" of wire

9 feet of wire

69
9
621 feet of wire

155.2 Equiv resistance

 10" x 10" Book 37 page 177

Surface 470 sq. in.

100 H.P. Machine

Resistance

10.64 Ohms resistance mill foot

	10.64	1.0273
Comp	162000	4.7905
	155.2	2.1908
		8.0086

0.0106 Ohms internal resistance

Lamp 165 Ohms

800 lamps

$800\,\big)\,165$

.206

.21

Will give ratio of 20:1

 Book 37 p. 176 20" X 30"

Surface 2488 sq. in.

600 lights 165 Ohms each

20 | .275 Ohms

.0137 conductor

.2887 $\bar{1}.4604$

.0106 $\bar{2}.0253$

1.4351

27.2

9 per H.P. 9 | 600

66.6 H.P.

66.6 1.8235

33000 4.5185

Comp 27.2 8.5654

~~comp~~ 80800 4.9074

comp 2488 6.6041

1.5115

32.2 ft. lbs per sq. in.

100 H. P. Machine

$132^2 : 115^2 :: 0.0106$

8.0086

2.0607

2.0607

7.8794

7.8794

7.8888

.00774

9.3139

7.8888

1.4251

26.6 to 1

Considering conductor

28 : 1

100 H. P. Machine

Suppose square wire

Bergmans Generator and bell

Handle up and down

$$\begin{array}{r} 3100 \\ 2 \\ \hline 6200 \end{array}$$

6200 Ohms rings bell

No Shunt

Turning generator by handle

$$\begin{array}{r} 1500 \\ 1100 \\ 3200 \\ 1600 \\ \hline 7400 \end{array}$$

Continually moving

6200

Bergmann's generator & Bill
new Aug 12 1880

Shunt	Line
500 Ohms	1500 2000 3500 Ohms
250 Ohms	700 2200 2900 ohms
100 Ohms	1400 Ohms
50 Ohms	600 Ohms
30 Ohms	500 Ohms
20 Ohms	300 Ohms
1.0 Ohms	100 Ohms
7 Ohms	Range

Running
5 Ohms

1.6902
7.5126
9.9957

9.1985 .158 Webers
9.3579

$\bar{2}$.5564 .0360 Volts

~~706 = D~~

$C = \frac{E}{R}$ Meter

R = EC
from Book 39, p. 121.

307.5 = D for 1 Volt
49 = D around 1.01 Ohms

$\frac{49}{307.5} \times \frac{1}{1.01}$ Webers

.158 Webers through the line.

Shunts 0.114
0.114
0.228 Ohms

$C = \frac{E}{R}$ $E = CR$

0.036 Volts on Shunt

Meters
from Book 39 p 121-

706. = D from 0.158 Webers on 1.016 Ohms

706

$$\begin{array}{r} 2.8488 \\ 0.7943 \\ \hline 3.6431 \end{array}$$

4400 = D from 1 Volts through galva. with shunt = ∞ both way

$0.158 = C \quad R = 1.016$

$C = \frac{\mathcal{E}}{R} \quad \mathcal{E} = CR$

$$\begin{array}{r} \bar{1}.1987 \\ 0.0070 \\ \hline \bar{1}.2057 \end{array}$$ .154 Volts

On page 124 4610

Line to Lamp factory

	325	2.5119
Comp	39.75	8.4008
	21.6	1.3345
		2.2471

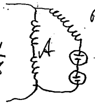
176 Volts

Deflection 325
with 27 Ohms. in Shunt

The galvanometer with a shunt = ∞ would give 4610 for a deflection with one Volt at its extremities.

Plan

$$\begin{array}{r} 0.114 \\ 0.114 \\ \hline 0.228 \end{array}$$



$$B = \begin{array}{r} 4.1 \\ 4.2 \\ \hline 8.3 \end{array} \text{ Ohms}$$

To give Weber thugh B

$$\begin{array}{rr} 4610 & 3.6639 \\ 8.3 & 0.9191 \\ \hline 38280 & 4.5830 \end{array}$$

To indicate one Weber through cells 38280 = D from galva

Meter from Book 39 p. 121

66 1.8195
38280 4.5830
.7.2365
.00172 Webers through cells

90 1.9542
Comp. 4610 6.3363
8.2905
2(.0195 Volts
0.00875 Volts on one cell

110 2.0414
Through cells 4.5830
.00287 Webers 7.4584

111 2.0453
6.3363
8.3816
(.02407 Volts
.012 Volts on one cell

180 2.2553
120 2.0792
1.5 .1761

2.4564
2.2227
1.71 .2337

Meter Book 39 p 125

180 2.2553
comp 38280 5.4170
.0047 Webers 7.6723
through cell
120 2.0792
6.3363
8.4155
1.026
.013 Volts on one cell

286 2.4564
5.4170
.00747 Webers 7.8734
through cells
167 2.2227
6.3363
8.5590
1.0362
.0181 Volts on cell

2.6042
2.2856
2.08 .318,6

4.1577
3.2386
.9191

4.5830
3.6639
.9191

402 2.6042
5.4170
8.0212

Webers .0105
through cells

193 2.2856
6.3363
8.6219

(.0418

.02095 Volts on one cell

Shunt changed 2000 Ohms

219 = deflection around A whereas 583 was the deflection before

583 : 219 :: 4610 :

3.6639
2.3404
7.2343
3.2386

1733
Deflection from one Volt

2.2646
1.8573
.4075 2.55

Meters; Book 39, p. 125.

583 : 219 :: 38280 :

4.5830
2.3404
7.2343
4.1577

14370

184 2.2648
Comp 14370 5.8423
8.1071

0.0128 Webers through cells

72 1.8573
comp 1733 6.7614
8.6187

1.04158

.0207 Volts on cell

Meters Book 39 p. 129

221 2.3444
5.8423
.01538 8.1867
Webers

79 1.8976
6.7614
8.6590
.3010
.0228 Volts 8.3580
on. one cell.

302 2.4800
5.8423
.021 8.3223
Webers

84 1.9243
6.7614
8.6857
.3010
.02427 8.3847
Volts on one cell

Meters Book 39 p 131

434 2.6375
5.8423
8.4798

.03010
Webers

98 1.9912
6.7614
8.7526

1566
283 35 Volts on one cell

3.14
205
1870
628
64370

3.14

360 2.5563
2.9891
5672

Meters, Book 39, p.89

1 0.147 Webers through cells
0.068 Volts on one cell

2 0.193 Webers through cells
0.083 Volts on cell

3 0.264 Webers through cells
0.105 Volts on cell

4 0.315 Webers through cells
0.123 Volts on cell

5 0.365 Webers through cells
0.134 Volts on cell

Suppose a shunt of .02 Ohms on a meter and 10 Ohms in with depositing cell

165 Ohm lamp
120 Volt

$\frac{120}{165}$ 2.0792
2.2175
9.8617

.727 Webers in the circuit for each lamp

.01 Weber flowing through

.01 19.7 mg. per minute

1 Weber

19.5	1.2900
60	1.7782
	3.0682

hours 5
Day 290 450 2.6532
5.7214

526.000 mg

.526 Kilo.

.268 lbs. of Cu per quarter

~~[illegible]~~

.01 Weber

.0268 lbs of Cu per quarter

.02 Volt due to polarization
and E.M.F. at .01 Weber

.727 Webers per lamp
in main circuit.

:01

$\frac{1}{100}$

10 Ohm

.01 Weston shunt

1 Lamp

.00727 Volt active on

also shunt .0727 Volt on .01 Ohm

10 Ohms with it

---

10 Ohms

.002 Weber

.2 Volt from resistance from cells
.023
.223 Volts at shunt

.001 Weber

.1
.02
.12 at Shunt

.005 Weber

.0

.01 Ohms shunt

01 .01

20 ⟌165
8.25

825 : 1 ratio 20 lamps
82.5 : 1 ratio 200 lamps
.1 Ohm shunt

82.5 to 1 20 lamps

or 8.2

.1 Ohm in shunt
for 20 lamps meter
can afford that much

~~at~~ .01 Weber flowing through cell deposits about .0268 lbs. of Cu. per quarter

a quarter contains 450 hours = 90 X 5

~~7000~~ grains make one lb
~~[illegible]~~ mg 1 gr
7,500
1 mg per hour

20 lamps

$$\begin{array}{r} .0268 \\ .020 \\ \hline 0.5360 \end{array}$$

1/2 lbs per quarter

Aug 19 1880 JFU

.005 Weber per lamp

20 lamps 1/4 lts per quarter

.005

On .1 Ohm Shunt
Page 105 .727 Webers
flowing through meters

.0727 Volts on shunt

$$.005\overline{)0.0727}$$
145.4

$\frac{1}{145.4}$ shunt ratio

1/4 lt. per quarter from
20 lamps

Estimate cost gas

Suppose

~~1~~4000000 Cost Gas
$3.600,000 received

4000000
.15
600,000.00

$600,000 M lost
$540.000 lost

Makes 4,600,000 M

36)460(12.8
36
100
72
280

4,6 .6628
3,6 .5563
.1065

~~8~~ 7.27

Estimate cost gas

4.6) 3.6 (

0,5563
0.6628
.8935

78.2 cts

4,6

3) 78.2 3

78.2)

4.600000 M yearly

4.6 X .782 ≠ 3.6

$4.6 = \frac{3.6}{.782}$

.78
600000

468000000

$464.000   .78

.78
2 000 000

$ 1,56 0000 000
468000
2)2.028 000 | 2600 000
1.014

2024000
$ 1.012

2.600.000

Estimate cost gas

Gas sold

2.000.000
600000

2.600000
1.800000   to sell at 90 cts

.2553
.4150

.8403

.69 cts must be made for

If 15% is lost of gas made. ~~90 cts~~ sold at 90 cts
cost 78.7 cts

If 1/2 of present amount is sold x
must be sold at $1.01

Electrodyne

$$f = \frac{c\,L\,m}{k^2}$$

$$c = \frac{f\,k^2}{L\,m}$$

1752
1.25
8760 4 layers
3504
1752
219.000

25 Volts
25
125
50
625
44.3
1875
2490
2490
$\boxed{27577.5}$
13788 3 magnets
40364

165
18

292 turns one layer

1752 gave 2 ohms
15 Webers
30 Volts
90 volts on 3 magnets

20 Volts
20
400
44.3
400
$\boxed{17720.0}$
8860 ft. lbs.

60
120
6 ohms

Must be able to get
25 Volts 12.5 Webers
on magnet

75 Volts on three magnets

125 Volts to spare

Strength magnet = C T

C = Current
T = No. turns

$R = \frac{V}{a}$ $C = \frac{E}{R}$

75 : 125 :: 6 : 10

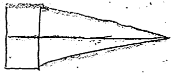
$$\begin{array}{r}125\\6\\\hline 750\end{array}$$

10 Ohms on magnet

Same length wire and same number of turns

$c^2 R =$ cost of current

$a T =$ ~~cost~~ wt of Cu



$c^2 R = \ m$

$a J = \ n$

$J c = X$

$\xi =$ variable

$R = \frac{J}{a}$

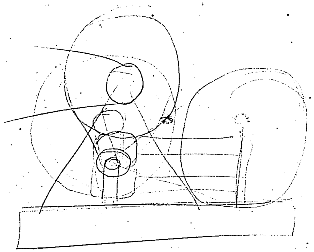
$c^2 \frac{J}{a} =$ Const.

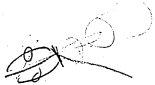
$C^2 R = m$ constants

$C^2 \frac{J}{a} = m$

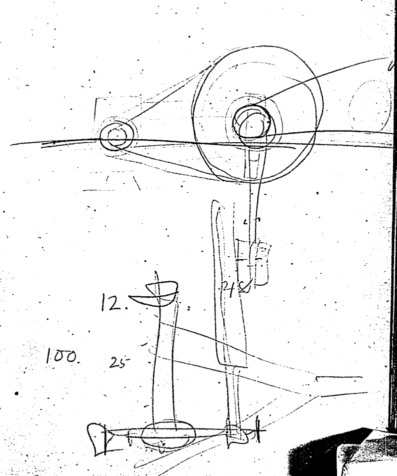
$c =$

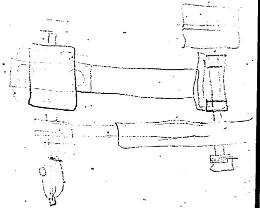
Motors



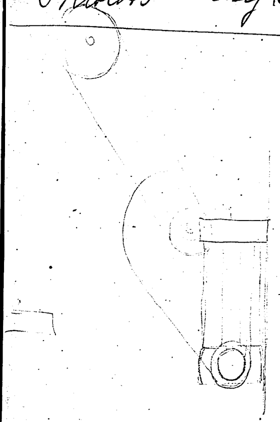


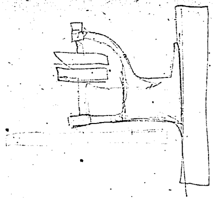
Motors aug 30

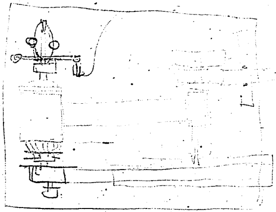




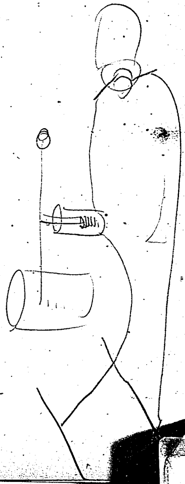
Motors Aug 30, 1880







12



Estimate of Motors

Mr. Edison makes condition that at 1000 r.p.m. the motor shall give 96 Volts.

Small wrought iron motor gives 65 Volts at 1640 revo.

6 turns ~~will give~~ to division

Large present 10" X 10" Machine

.55 Ohms at 1100 revs

gives 220 Volts

at 1000 revs 200 Volts

200 lbs
50 600 lbs of Cu 10

2

97

1 ct an hour
8
8 cts per day

365
.08
$ 29.20

$292
72

3 layers
$60 per layer
4 13

1752
12.5
8770
3504
1752
21901.0

1752 turns of .134 wire gives .2 ohms

12.5 Webers saturates

25 Volts in magnet with 3/120 Volts on line
40 Volts for each magnet to give same strength.

No. 11 Wire
.120 in diameter

7"½ diameter

3' 6"½

.120	
.013	
.133	

12
3
36
6.5
42.5

.133) 42.500 (319.5 Turns
399
260
133
1270
1197
730

~~25 volts~~

~~2.8) 25.0 (9. Webers~~

~~1919~~
~~9~~
~~17271~~

40 volts

2.8) 40 (14
28
120
104
160

3 layers

7.5
0.133
.066
7.699

wrong

958.5
2
1919 turns

319.5
3
958.5
7.7
6706
6706
12) 7371.6
614 feet
2
1228
3.1 = π
1228
3684

1392) 3806.8 (2.73
2784
10228
9744
4840

2.8 ohms

1919 3.2833
.1139
3.3972

40 Volts 1.6021
.3636
1.2385
3.3972
432 4.6357

4 Layers No. 11 Wire

7.5
.133
.066
.133
.066
7.898 diameter

Wrong

7.9
3.1
79
237
24.49 24.5 one turn

24.5 1.3892
1919 3.2833
comp. 12 8.9208
feet 3920 3.5933
1.33 .1139
3.7072
5100 3.1436
1392 .3636
3.6 Ohms

43.56   163 91

6700   1.8284

5.4675

293 lbs

5 Layers No. 11 Wire

7.5   .133

.1665   .5

8.165   .665

3.1   .4914

8.16   .9117

319.5   2.5045

3195 turns   10   1.

Comps 12   8.9208

6700 feet   3.8284

1392   3.1436

4.8 Ohms   .6848

40 Volts   1.6021

.6848

.9173

3.5045

26400   4.4218

No. 12 Wire magnet large machine

.109 = Diameter
.025
.134 = Space taken by wire

3
12
36
6.5
42".5 length of magnet

42.5 1.6284
.134 $\bar{1}$.1271
2.5013 317 turns

5 layers .134
5
.670

7.5
.67
8.17
3.14
317
10
comp 12
6780 feet

0.9122
0.4969
2.5011
1.
8.9208
3.8310

4[illegible]

[illegible]
600

756600
43

5 | 758600
11[illegible]

6780	3.8310
1149	3.0603
5.9 Ohms	.7707

40 Volts 1.6021
.7707
678 Weber .8314

3170	3.5011
	4.3325

21500

5 layers

6 Ohms

6780
3

20340 feet	4.3083
35.9	1.5551
	2.8634

730 lbs.

3.281
12
6562
3281
$39''.372 = 1$ Meter

$1^{mm} = 0''.0394$

$\frac{39.4}{1000}$

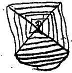
39.4
6
218.4

583   21.7657
.0394   2.5955
23.00   4.3612

German Silver Book 104 page 53

.0106 $a =$ thickness
$b =$ width

$$R = \frac{L}{ab}$$



$$R = \frac{L}{ab}$$

0106

X = Resistance per square mil ~~1 foot long~~ 1 inch long

$$R = \frac{L}{ab} X$$

$$X = \frac{abR}{L}$$

$a = 11.$
$b = 6^{mm} = 39.4 \times 6$
$= 218.4$

$L = 583^{mm} = 23.$

39.4 | 1.5955
25 | 1.3979
985 | 2.9934

437 | $\bar{2}$.5955
 | 2.6405
17.2 | 1.2360

$$X = \frac{11 \times 218.4 \times .16}{23.}$$

1.0414
2.3385
$\bar{2}$.0253
8.6383
.0435

1.0414
2.3385
$\bar{1}$.2041
8.6383
1.2223
16.
1.10 Ohms

Strip No. 2

Res = .0216 Ohms
Thickness = 0".011 = a
Width = 25 mm = b
Length = 437 mm = L
a = 11.
b = 985.
L = 17.2

$$\cancel{X} = \frac{a b R}{L}$$

~~136~~ 13.6

1.0414
2.9934
$\bar{2}$.3345
8.7640
1.1333

39.4	1.5955
.608	$\bar{1}$.7839
	1.3794

39.4	1.5955
35	1.5441
	3.1396

Strip 4

Res = 0.0222 Ohms
Thickness = 0".011
Length = 608 mm
Width = 35 mm

a = 11
b = 1380
L = 23.9

1.0414
3.1396
$\bar{2}$.3464
8.6206
1.1480

14. ~~140~~ Ohms

sq. mill inch ~~138~~ 13.8

The smallest circuit will have 30 lamps on all the times.

$$30 \overline{)16.5} \text{ ohms}$$
5.5 ohms total

120 Volts on 5.5 ohms

120 volt

120 : .04 :: 5.5 : X

$$
\begin{array}{r}
.04 \\
120\overline{).220} \; .00183 \\
120 \\
\hline
1000 \\
960 \\
\hline
400
\end{array}
$$

Shunt 0.00183 Ohms

3" X 12" XX

$L = 12$

$b = 3000$

$a = x$

$R = .00183$

mil inch $= 1.38$

$$\frac{13.4}{\cancel{1.38}} = \frac{x \times 3000 \times .00183}{12}$$

$$x = \frac{12 \times \cancel{1.38}\ 13.8}{3000 \times .00183}$$

$$\begin{array}{r} .00183 \\ 3000 \\ \hline 5.49000 \end{array}$$

$$\begin{array}{r} 13.8 \\ 12 \\ \hline 276 \\ 138 \\ \hline 165.6 \\ 5.49 \end{array}$$

$$\begin{array}{r} 2.2175 \\ 0.7396 \\ \hline 1.4779 \end{array}$$

$x = 30$

Nov 25 1880

67.75

12.25

1,8309
2
3.6618
2.1762
1,4856
3010
1.7866

1.0881
2
2.1762

61.2
~~62~~ candle

$$\begin{array}{r} 12 \\ 8 \\ \hline 96 \\ 8.5 \\ \hline 104.5 \end{array}$$

Nov. 26

1.54 Ohms

8 feet 8 ½ inches

gives 1.54 Ohms

1.54 : 10 :: 104.5

1.54) 104.5,00 (677 inches
924
1210
1078
1320

50 feet

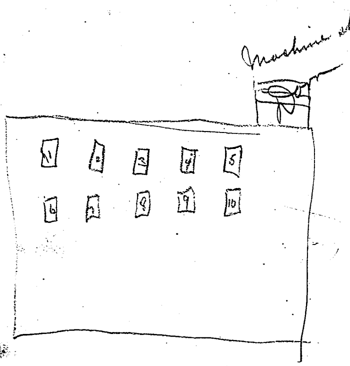
12) 677
56 feet 5 inches

60 feet 1 Ohms

6 1 Ohms

Machines for multiple arc. The magnet for ~~the~~ a .55 Ohm machine ran by the exciter

This machine ran the fields of nine ~~other~~ machines in series each .14 Ohm



1 Machine No. 5 160 R

2 " No 4 158 R

3 " No. 3 160 L

4 " No. 11 153 L

5 " No. 10 160 R

6 No 7 148 L

7 No 6 153 R

8 No — 147 R

Machine No. 5 150 R
" 4 157 R
No 5 155 R
No 4 157 R
No 3 157 R
No 11 148 R
No 5 149 R

40 lbs steam

No 11 150 R
6 159 R
No 5 155 R
No 6 155
No 7 150

No. 5	145
10	153
No 5	142
No. 10	150
No —	141

20 lbs steam

No. 5.	145
No 10	156
No. 6	150.
No 5	153
No 10	160

No 5	148	
No 4	146	
No. 5	148	
No 3	148	
No. 5	150	
No. 11	148	
No. 5	150	
No. 10	160	
No. 5	150	
No. 7	154	
No. 5	150	
No. 6	152	
No. 5	148	No. 5 145
No. 6	148	
5	145	
	142	

a 303
168-168

307
170-170

312 a

160-160

318a
160-160

322a
165-165

328a
172-172

320a
170-170

308a
175-175

313 a
175 - 175

---

320 a
165 - 165

325
166 - 166

329
152

Dec. 23, 1880.

Test of small wrought iron motor. Field wound with 70 Ohms of No. in multiple arc with ~~armature~~
armature .61 Ohm

Copper plates placed in line with armature

wt Cu plates

No 1 117.272 Grammes
" 2 118.000 "
" 3 117.170 "
" 4 116.380 "

Motor running
2400 r. p. m

140 = D around terminals

2-56 Started
Second hand at 30"

2-59 $\frac{1370}{2}$
$\frac{}{2740}$ r. p. M

140 = D

117.530
117.272
258

118.000
117.690
.310

117.170
116.850
.320

116.635
.380
255

Wrought iron motor 2600 r.p.m.

3-6 Stopped

1900 revs in 3/4 minute
633 $\frac{3}{4}$
2532 r.p.m.

Plates

No. 1 117.530
2 117690
3 116850
4 116.635

Result
6000 ~~ft~~ lbs. required
~~to~~ drive motor 2600 r.p.m.

1.45
.6
.860

40
40
1600
40
64000

140
140
1280
93 Volts

1.45
93
435
1305
134.85

135
44.3
405
540
540
5980.5
6000

6000 ft. lbs

258
310
320
255
1143
10 | 286 mg

19.7) 28.6 (1.45 Webers
19.7
8.90
788
1020

$C = \frac{E}{R}$

$R = \frac{E}{C}$

Work $= \frac{E^2 \, 44.3}{R} = \frac{E^2 \, 44.3}{\frac{E}{C}} = E.C. \, 44.3$

5 lamps

5 | 130
26 Ohms

.61

~~100~~
100
~~10000~~
.6) ~~443000~~ 0
33) 738,~~300~~
23

3.7686
0.3979
0.0654
4.2319

3.7686
.1761
0.0654
4.0101

3.8340
10000 ft. lbs.

3.4116
1.9645
6.5850
1.9611

93.0
91.5
1.5

.86 : 1.5 :: 5870 : X

2000
1.980

Jan 1881
GRM

2600

1,45 Webers
93 Volts at terminals

.6 Ohm = resistance

.86 Volt active
5870.5 ft. lbs

2600 : 2580 :: 92.14 : X = 92.14

93
.86
92.14

2600 : 1600 : 93
13 8
8
13) 744 (57
65
94

2580 : 2560 :: 91.5 : X

1.9614
3.4082
6.5884

1.9580
93
90.8

2.2

3.8340
.3424

4.1764

15,000 ft. lbs.

61 Ohm

Rewind so as to
give 1.75 Ohms and
twice the turns
E.M.F.

1300 revo. per minute
Same E.M.F.

= 92.14 Volts contrary
.86 " active

92.14 Volts

92.14

3000 ft lbs saved by slower
speed

2580 : 2560 :: 91.5 : X

1.9614
3.4082
6.5884
———
1.9580
93.
90.8
———
2.2

3.8340
.3424
———
4.1764

15,000 ft. lbs.

61 Ohm

Rewind so as to
give 1.75 Ohms and
twice the turns ~~or~~
E. M. F.

1300 ~~Revo.~~ per minute
Same E. M. F.

= 92.14 Volts contrary
.86 " active

~~Counter volts~~
~~Counter volts~~
92.14 Volts

92.14

3000 ft lbs saved by slower
speed

γ_2

$\boxed{110}$

110 Volts on line
92.14
17.86

17.86 Volts active

1.2520
1.2520
1.6464
9.7570
3.9074 8080 on machine as heat

110
92.14 1.9645
17.86 8.7480
8080 3.9074
4.6269

41,700 ft-lbs from motor

NYANY

92.14 1.9645
.110 2.0414
.9231

~~83.8%~~ 83.8%

of speed that is needed to equal whole E.M.F on line.

No regulation needed

12
6
7.2

13
7
91

16
9
144

9) 33000
3666.

72
91
16

1.18573
8.0481
1.7041
1.1015

12.6 candles
8.4 candles

9) 2550
283 ft. lbs

33000

4.5185
2.4518
2.0667
1.2041
.8626

116

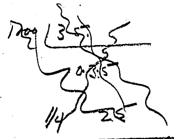
7.2 per H.P.

178
9.8

11. per H.P.

~~5.5 lamps~~

12	13	141
144	13	23
	39	164
	13	
	1.69	



165 Ohms

165	2.2175
169	7.7721
144	2.1584
~~165~~	2,1480
141	2.
24	

2.2175
2.1480
.0695
0.7782
.8477

1.17

7.04

5 1/3 candles

2250   3, 3522
5.33   0. 7267
2.6255

422 ft. lbs per candles

4.5185
2.6255
1.8930

78 candles per H. P.

1.8930
.7267
1.1663

14.6

Lamp Aug. 8, 1880

16   33 ozs   4.5185
7   112   2.0492
112   2.4693

295 ft. lbs per candles

16
8

Present lamps 4" loop
9 candles.   6" loop
4 1/2
13 1/2 candles   9/8
12 ~~1/2~~ candles

7 per H. P.

About 12 candles

1/4 more surface added will give 16 candles

$$R = \frac{a\,l}{d^2}$$

$$S = b\,l\,d$$

$$R\,d^2 = a\,l$$

$$d^2 = \frac{a}{R}\,l$$

$$d = c\sqrt{l}$$

$$S = c\,b\,l\sqrt{l}$$

$$l = \left(\frac{S}{cb}\right)^{\frac{2}{3}}$$

$$S = \frac{5}{4} = 1.25$$

.0969
2
.1938
.10646

2.85
.021
2.85
570
.05985

.021
3.
.063

.12
2.4
.0096

.0096
4.8
.009
~~.0405~~
.0432 .6"

6
2
1.2
4.8

Menlo Park Notebook #115 [N-80-07-19]

This notebook covers the period July-October 1880. The entries are by Charles L. Clarke. The book contains calculations, notes, and drawings relating to the electric railroad, especially the design of the locomotive. There are also four pages of notes and calculations about copper conductors and two scaled template patterns for dynamos. The label on the front cover is marked "C. L. Clarke." The book contains 284 numbered pages.

Blank pages not filmed: 142-279, 284.

xE-172
N-80-07-19

What resistance of lamps.
What do for field magnet.

$\frac{1}{100}$ 100 feet

Clarke

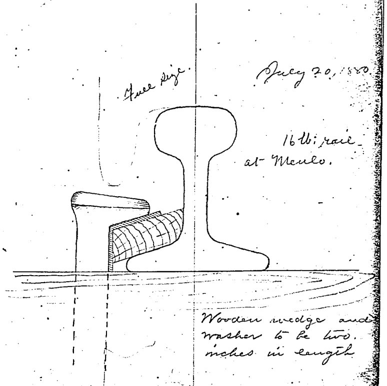
16

Electric locomotive.

July 19, 1880.

Head light.
Whistle. Clarke
Brakes.

July 20, 1880.



Full size

16 lb. rail at Menlo.

Wooden wedge and washer to be two inches in length

33)528(16
33
198
198

54
150
2700
54
8100

33)105600(3.2
99
66

A standard light passenger car on the Penn. R.R. weighs 39 300 lbs. and carries 54 passengers.

Speed 30 m. per hour or 2640 feet per m.

If we take a ton as 2000 lbs. and resistance as 10 lbs. per ton, each ton will consume 2640 × 10 = 26400 ft. lbs. per m. at speed of 30 miles per hour. Each car (20 tons) would therefore require 26400 × 20 = 528 000 ft. lbs. = 16. H.P.

Suppose the passengers to average 150 lbs. weight, the total will be 54 × 150 = 8100 lbs = 4 tons

The power consumed due to passengers will be 26400 × 4 = 105600 ft. lbs. = 3.2 H.P.

The H.P. required per loaded car will be 19.2 H.P.

over

$\frac{16}{100}$ $\frac{16}{6500}$ 16)6500(400
52.8
.0400
21120

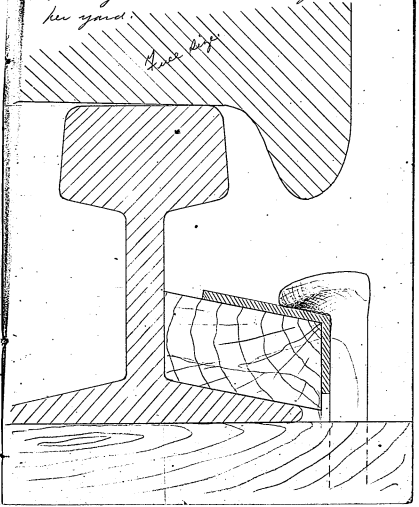
52.8
.04
2.112

The entire weight of one loaded passenger car is 24 tons and the resistance due to that car is (24 × 10) = 240 lbs.

5 cars would require (19.2×5) = 96 H.P. and a resistance (240 × 5) = 1200 lbs. and if only one tenth of the weight on driving wheels is the adhesion (it often being as high as one fifth or even one third under most favorable conditions of track and weather) the required weight is 1200 × 10 = 12000 = 6 tons.

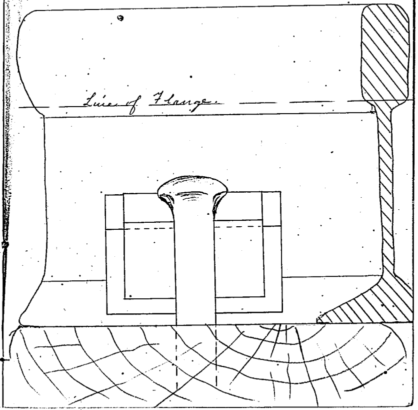
July 21st 1880. Clarke,

Standard steel or iron rail on Pennsylvania R. R. weighs 67 lbs. per yard.



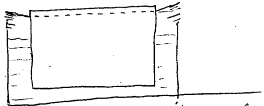
July 21st 1880.

Clarke.

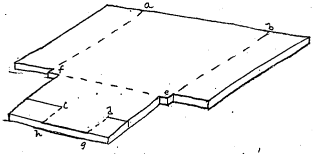


Clarke.

Instead of making the angle-washer shorter than the wooden insulation, thereby crushing into the wood on account



of pressure of spike when the rail buckles in the passage of a heavy load, it may be cut in this shape and then is to be

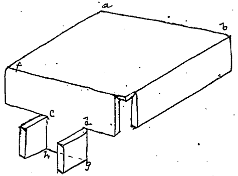


bent along the dotted lines

July 21, 1880.

Clarke

as shown below; the wooden insulator and angle washer are thus

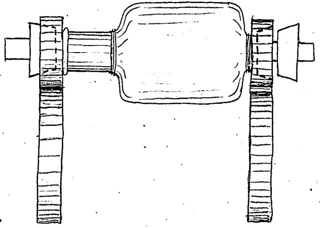


held immovable by the spike.

If the wood be two inches long there will be four square inches bearing on the flange, I think it advisable to make it three inches in length.

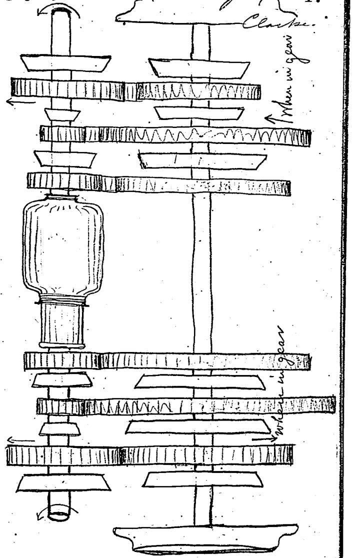
Even if not thought desirable to flange the angle washer it out to have a length equal to that of the wood.

Electric - locomotive. July 21, 1880
Clarke.



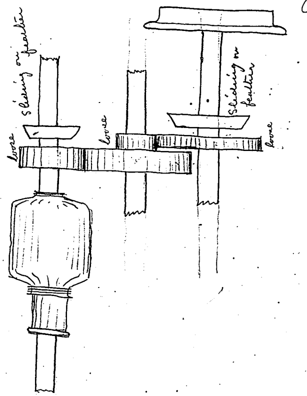
Electric locomotive — July 21, 1880. Clarke.

Spur wheels all loose, Cone clutches sliding on feathers,



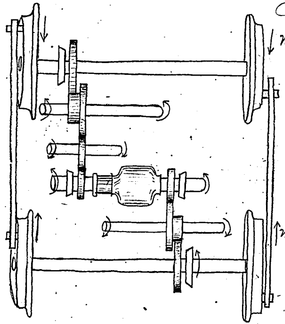
Electric Locomotive, July 22, 1880,

Clarke,



Electric locomotive, July 22, 1880.

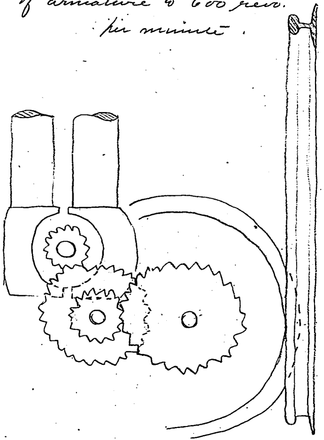
Clarke.



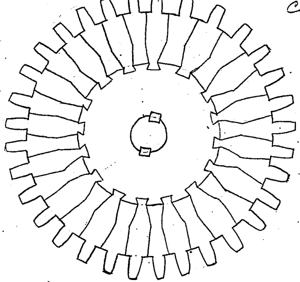
Spur wheels loose,
Cone clutches sliding on feathers.

Clarke

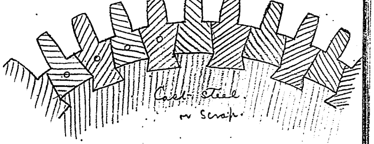
Reduce the constant speed of armature to 600 rev. per minute.



Electric locomotive. July 22, 1880,
Clarke

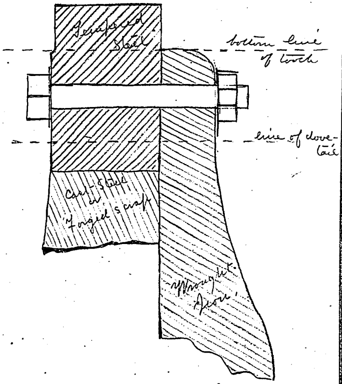


Tempered steel teeth.



Electric Locomotive, July 23 27
1880,

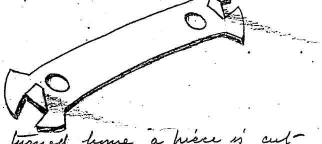
Section of tooth showing Clarke.
fastening



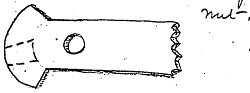
Electric locomotive, July 22, 18

Clarke,

Each pair of bolts will be connected by a double washer and after the nut has been



turned home a piece is cut out as shown in figs. and bent up, thus locking the nut.

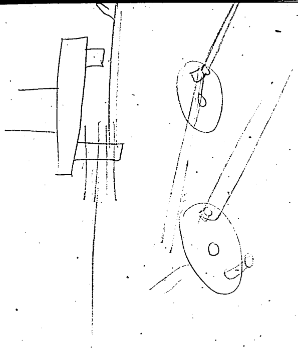


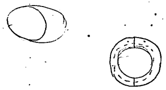
The same arrangement is to be on the bolt-heads on opposite side.

Electric locomotive, July 23 '1880

Same size as the 120 H.P. dynamo-electric machine, Clarke.

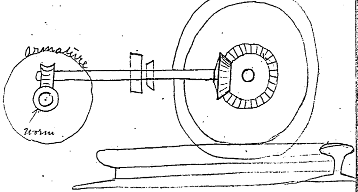
Weight of Fields	3324 lbs.
Brass Field Plate	300 lbs.
6 Cores	3108 lbs.
Copper wire	804 lbs.
Heads	2160 lbs.
Armature without shaft	2487 lbs.
	12183 lbs.

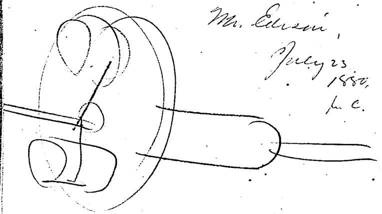




Electric locomotive, July 23, 1880.

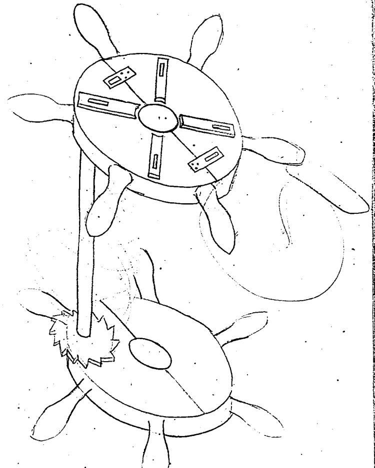
Clarke.

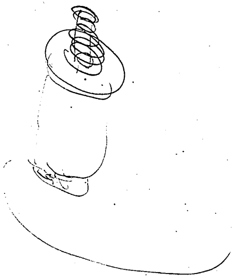




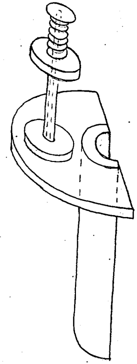
Mr. Edison,
July 23
1880,
J. C.

Sewing machine, July 23, 1880.
Clarke.

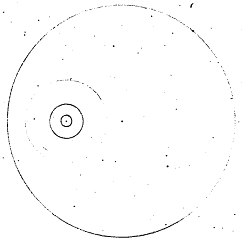


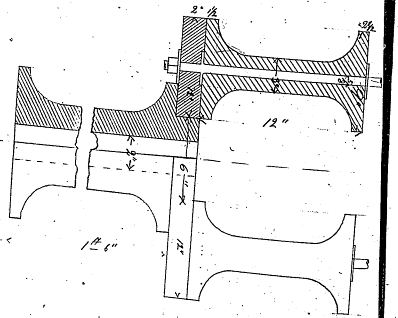


Sewing machine, July 23, 1880, Clarke.

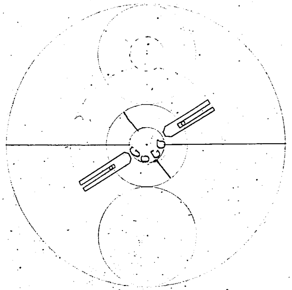


Sewing machine, July 23 1880,
Clarke



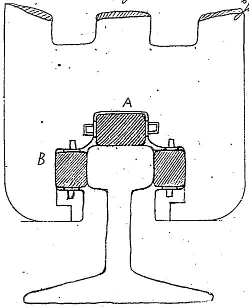


Sewing Machine. Scale 2 in to 1 ft. July 23 1880, Clarke.



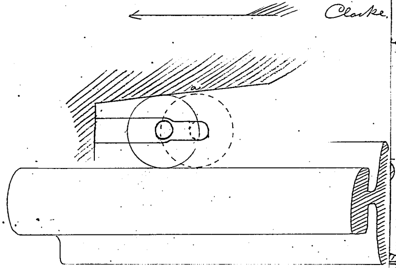
Roller clutch for climbers.

July 26, 1880
Clarke,



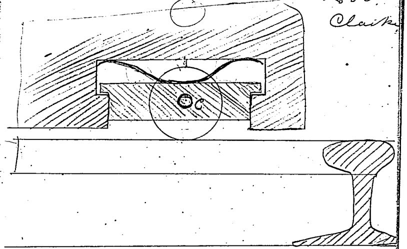
Cross-section showing the top roller which is simply to prevent sliding friction when clutch moves forward. Side rollers clutch.

Roller clutch. July 26, 1880.
Clarke.



Plan of clutch rollers on side of rail head, showing the guiding groove for axle, which groove takes the axle after the pressure is off and prevents sliding friction at a: and also limits the play of the roller.

Roller clutch. July 26.
1880.
Clarke



The anti-friction roller
on top of rail. When the
clutch rollers tighten and
thus as a fulcrum would
tend to bring a pressure on
the axle C the spring allows
the rail and shoe to come
in direct contact with roller,
thus preventing strain on C.

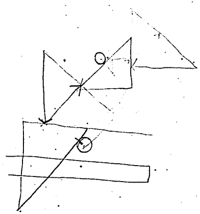
80 120

20 25

6

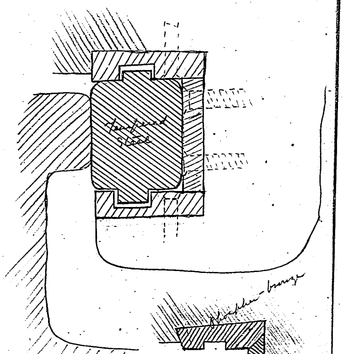
36 81

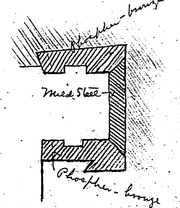
$$\begin{array}{r} 36 \\ 3 \\ \hline 1.08 \end{array} \qquad \begin{array}{r} 81 \\ 2 \\ \hline 162 \end{array}$$



Roller clutch, July 26, 1880.

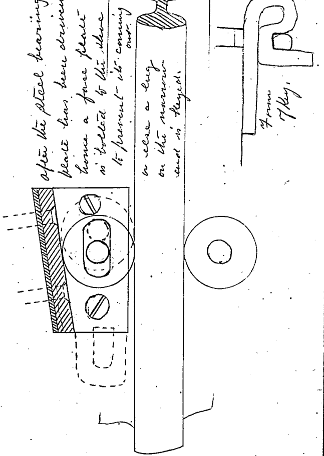
Clarke



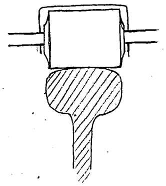


Roller clutch. July 26, 1880.

Clarke.

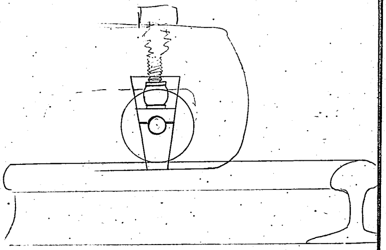


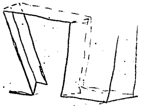
Roller clutch. July 26, 1880,
Clarke.



Roller clutch, July 26, 1880

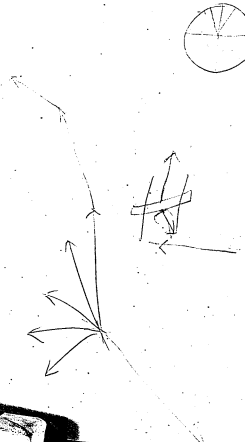
Clarke





3/16

11/32



Efficiency of the worm
on 1st geared locomotive July 27. 1880.
1½ pitch, 7½ pitch diam. Clarke

3,14
7.5
1570
2198
1.5) 23.55 (15.7 nat. tan. of θ
15
85
75
105
105

Angle 86° 21′

$\theta - \varphi = 86^\circ 21' - 4^\circ 18' = 82^\circ 3'$

$\frac{1}{\tan.\theta} = .0636$

15.7) 1.0000 (.0636
942
580
471
1090
942

$\frac{1}{\tan.(\theta-\varphi)} = .1396$

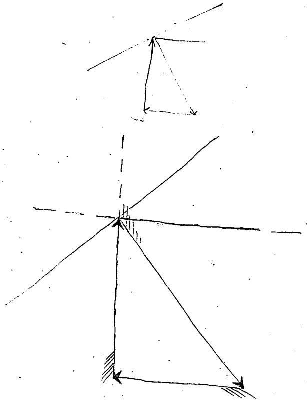
7.1607) 1.00000 (.1396
71607
283930
214821
691090
644463
466270

$\frac{\tan\theta}{\tan(\theta-\varphi)} =$

7.1607) 15.7000 (2.1925
143214
137860
71607
662530
644463
180670
143214
374560
358035

2,1925 is the Counter efficiency

See Engineering Vol. XIX, No. 473, pages 73 & 74. Jan. 22. 1875.



This is upon the assumption that the angle of friction is $4°18'$ or, its tang. and coeff. of friction are .075.

If we suppose the coeff. to be only .05 the angle of which is $2°52'$.

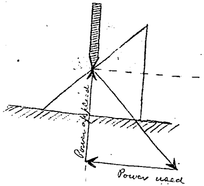
then $\theta - \varphi = 86°21' - 2°52' = 83°29'$

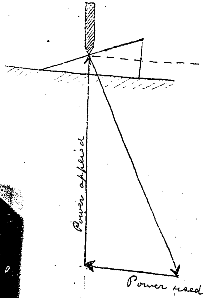
$$\therefore \frac{\tan\theta}{\tan(\theta - \varphi)} = \frac{15.7}{8.754} =$$

$$
\begin{array}{r}
8.754)\,15.700(1.7935 \\
\underline{8\,754} \\
69460 \\
\underline{61278} \\
81820 \\
\underline{78786} \\
30340 \\
\underline{26262} \\
40780
\end{array}
$$

1.7935 is Counter efficiency.

1.47) 1000 (.70
1.79) 1000 (.60



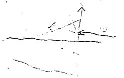


In unusually favorably the coff. of friction has been (Rankine) as low as .03

angle of .03 = $1°43'$

then $\theta - \varphi = 86°21' - 1°43' = 84°38'$

$\therefore \dfrac{\tan\theta}{\tan(\theta - \varphi)} = \dfrac{15.7}{10.65} =$



```
10.65) 15.70 (1.474
       10 65
        5050
        4260
         7900
         7455
          4450
          4260
           190
```

Counter efficiency

when coff. of friction is .03
1.474

When coff. of friction is .05
1.7935

When coff. of friction is .075
2.1925

$\sqrt{1,0009}$ 1,0004

20004) 00090000
80016
200085) 998400

1,00045
1,00045
500225
400180
100045
1,0009002025

1,0309) 23,5500(22,8
20618x
29320
20618
87020

$\sqrt{1,0025}$ (1,00125
2001) 002500
2001
20022) 49900
40044
200245) 985600

1,00125
1,00125
500625
200250
100125
1,0025015625

1,0525) 23,5500(22,4
21050x
25000
21050
39500

$\sqrt{1,005625}$ (1,0028
2002) 005625
4004
20048) 162100

.075
1,0778

2
1,002
1,002
2004
2004
1002
1004004

1,0778) 23,5500(21,8
21556x
19940
10778
91620

If p = pitch
r = radius of pitch circle
f = coeff. of friction
then the counter efficiency will be least possible when

$$p = \frac{2\pi r}{f + \sqrt{1+f^2}}.$$

The economical angle is given by formula

$$\tan\theta = \tan\varphi + \sqrt{1+\tan^2\varphi}$$

where θ is the angle which thread makes with axis of screw and φ is the angle of repose.

Since in present case $2\pi r = 23.55$

when $f = .03$

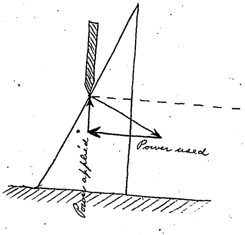
$$p = \frac{23.55}{.03+\sqrt{1+.0009}} = \frac{23.55}{1.0309} = 22.8$$

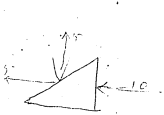
When $f = .05$

$$p = \frac{23.55}{.05+\sqrt{1+.0025}} = \frac{23.55}{1.0525} = 22.4$$

When $f = .075$

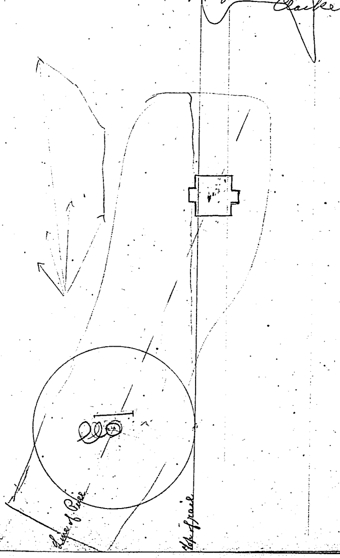
$$p = \frac{23.55}{.075+\sqrt{1+.005625}} = \frac{23.55}{1.0778} = 21.8.$$





Roller clutch, July 27, 1880,

Clarke.



14" dynamo machine

Diam. of iron plates 14".
51 Commutators.
102 notches.
404 turns.
.431" to 1 notch.
.030" for peg.
.401" for wire.

4 wires in each notch side by side.
Each wire .100" diam. including covering.
.013 allow for covering.
Actual diam. of wire .087".
Contains 7570 circular mils.
And 8 contain 60560 c. mils.

Dimensions
of Armature

9)5.4
.6
.8
.48

4)3.6
.9

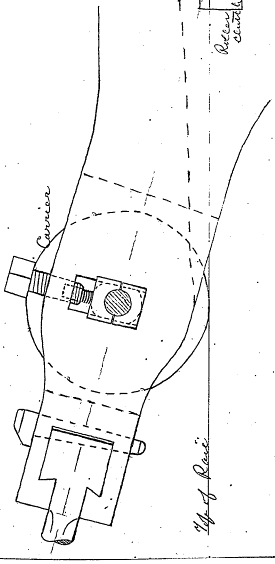
Armature 20" long.
14" diam.
34"
2
68" Distance around
6" for ends
74" Total
102 turns
148
74
12)7548 Inches of wire
4)629 feet "
157.2

Resistance of machine .0244 ohms

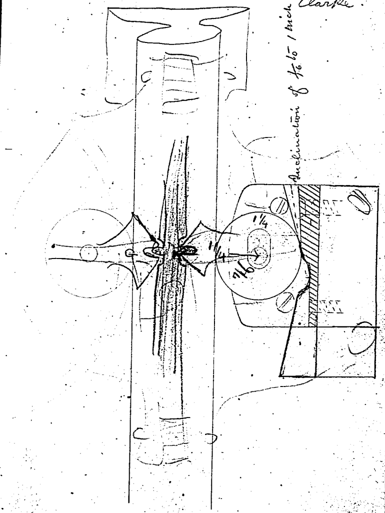
Dimensions of Armature.

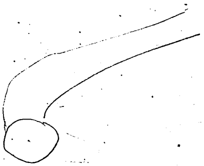
Roller clutch, July 28th 1880.

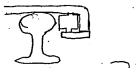
Clarke

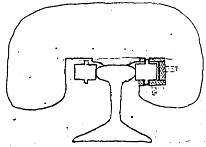


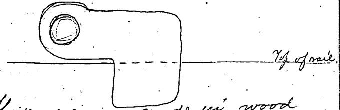
Roller clutch, July 28, 1880
Clarke.



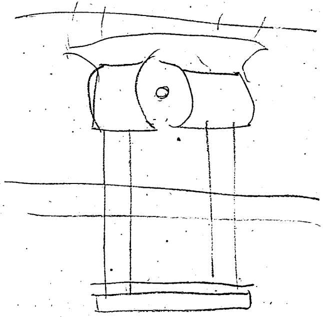




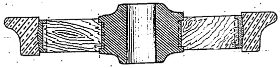




The model was made in wood by John Ott and tested July 29th 1880 Worked very satisfactorily.

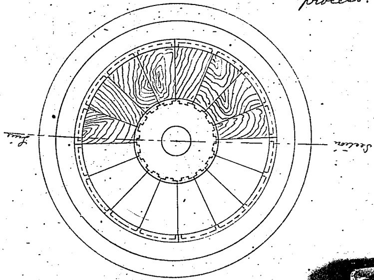


Electric locomotive.
Insulated car wheel July 29, 1880,
Clarke.



See page 89.

Why not use wood
treated by the resin
process?

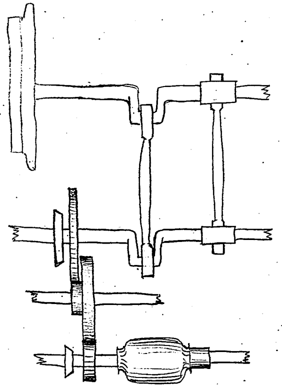


Electric Railway. July 30, 1880.
Clarke.

Instead of having the motor gear directly into a spur wheel on the driving wheel axle (for then we cannot place the locomotive on springs and must have everything rigid, which will strain all the parts and must frequently break the axles) I propose to gear to an intermediate shaft and connect this shaft with driving wheel shaft by connecting rod and there take up the motion. and place locomotive upon springs

over

Electric Railway. July 30, 1880.
Clarke.

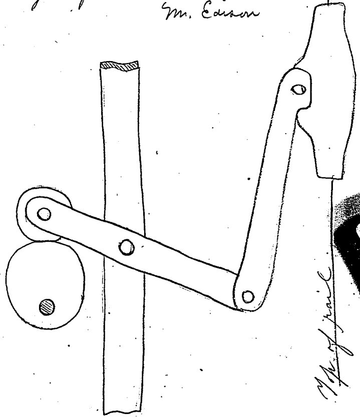


Two rods at right angles
may be used as in fig.

Electric Railway; July 30, 1880.

Clarke.

Cam gear for creeper
Mr. Edison

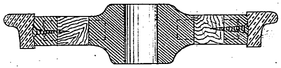


How is this to be brought back
excepting by a spring?

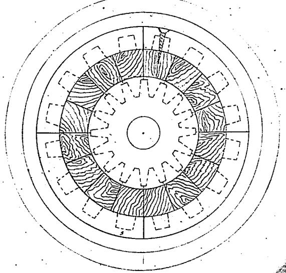
See page 93

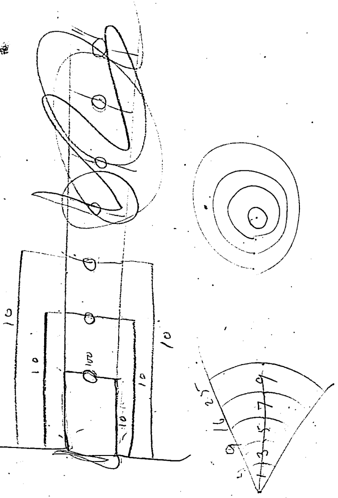
Electric Railway, July 30, 1880, 89

Insulated Car wheel. Clarke.



Allow a clearance between each mortice and tenant. See page 87
Wood screws or dowels driven into wooden spokes.

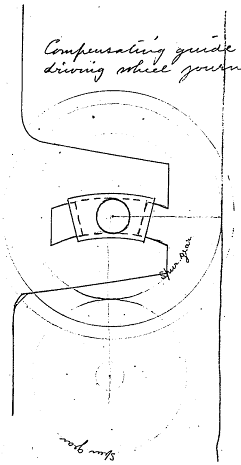




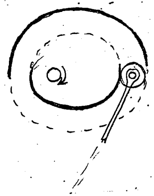
Electric railway, July 30, 1880.

Clarke.

Compensating guide for driving wheel journal.

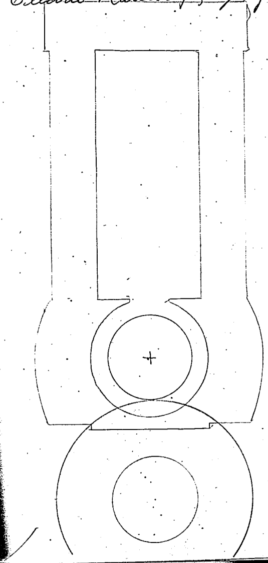


Electric Railway. July 30th 1880.
Clarke.
See page 87.

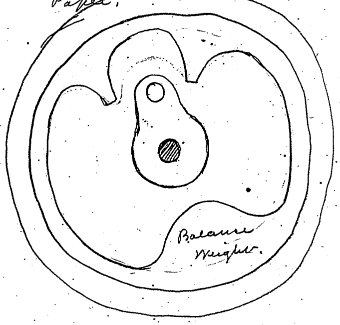


By having an inside and outside arm the creeper can be pushed forward & doing away with the spring.

Electric Railway, July 3/21/1880
Clarke



Electric Railway. Aug 2, 1880.
Driving wheel of Clarke
Paper.



3.14
2.6
1884
628
8.164
224.2
16328
32656
16328
16328
1830368

224.2) 1884.0(8.4
1793 6
9040
8968
720

3.14) 8.40(2.7
628
2120
1884
2360

Weight of armature with
copper 2500 lbs.
Fields 3324 lbs.
Cores 3108 lbs.
Wire 800 lbs.
Heads 2160 lbs.
11900 lbs.

Aug 2. 1880
Clarke

5 3.14
5.
15.70

5280
2
3)10560
15.7)3520.0(224.2 turns of driver
3144
380
314
660
628
320

40 m. per h
is 2/3 m. per min.

40 miles per hour

Wheel on armature shaft-
1' diam.
600 revo. per m.
Circum. 3.14 ft.
Circum. velocity 1884 feet per m.

Spur on driving wheel
diam. 2.6 ft.
Revo. per mile 224.2
Circum. 8.16 ft.
Circum. velocity 1830 ft. per m.

If a maximum of 200 H.P. is ever required at 40 miles per hour.

We have 6600000 ft. lbs. per minute.

Speed 3520 ft. per m.

Therefore pressure on teeth of spur wheel at armature

```
3520)6600000(1875
     3520
     30800
     28160
      26400
      24640
       17600
       17600
```

= 1875 lbs.

If same H. P. is developed at speed of ten miles per hour we have speed per minute $= \frac{5280}{6} = 880$ ft., and pressure on spur wheel is

```
880)6600000(7500
    6160
     4400
     4400
```

= 7500 lbs.

We will then consider 10 000 as the greatest strain coming on the teeth of the spur wheel on armature shaft. According to Tredgold the stress should never be greater than 4500 lbs. per sq. in. of section across the tooth

and the tooth should be broad enough across the face for the same reason. This is for cast iron. If then we make the gears of steel we certainly can assume $2\frac{1}{2}$ sq. in. as safe.

36) 37.6992 (1.0472
36
169
144
259
252
72
72

24) 37.6992 (15
24
136
120

3.1416
15
157080
31416
47.1240

36) 47.124 (1.31
36
111
108
32

12 : 21 :: x : 31

31
12
21) 372 (18
21
162

21
3
63

31
3
93

93 : 600 :: 63 : 600
93) 37800 (406
372
600

Diam. of gear 1 ft
Circum. 3.1416 ft.

If Three pitch then
36 teeth
Circum. pitch = 1.0472"
Will not give cross-section enough

If 2 pitch then
24 teeth
Circum. pitch = 1.5
Not cross-section enough.

Diam. of gear 15 in
Circum. 47.124 in

If 3 pitch then
36 teeth
Circum. pitch =

Not applicable

3.1416 × 1.5 = 4.71240

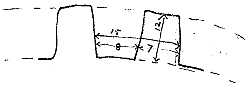
36) 56.8 (1.58

7 × 12. = 84

84 : 225 :: 2.5 : 6.7

225 × 2.5 = 562.5

84) 562.5 (6.7

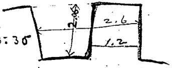


~~7 : 15 :: 2.5 :~~

84 : 180 :: 2.5 : 5.36

180 × 2.5 = 450

84) 450 (5.36



7 : 84 :: x : 2.5

7 : √84 :: x : √2.5

84) 17.5 (.21

9.17) 11.06 (1.2

84) 30.0 (.357

1.2 : 7 :: x : 12

7) 14.4 2.06

If armature be increased to 31 inches and gear to 1′6″

Then when

3 pitch

54 teeth

Circum. pitch = Circum 4.7 ft = 56.8″

= 1.~~"~~

2 pitch

36 teeth. The pitch in order to get a tooth of the proper cross section should have Circum. pitch of 2.6″, which means a width of tooth 1.2 and height 2.06 giving cross-section of 2.47 sq. in.

2.06 × 1.2 = 2.472

1.2 : 7 :: x : 15

~~[illegible]~~ If we assume 2 sq. in. for steel

9.17) 9.898 (1.0

1.414 × 1.5

9.17) 21.210 (2.3

9.17) 16.968 (1.85

15123;;42

2.3

42
23
126
84
15) 966 (64
90
66
60

5" 4"

18
2512
314
23) 56.52 . 24.5
105
132

24

18
18

3.14
15
1570
314
21) 47.10 (2.243
42
51
42
90
84
60

18) 47.10 (2.62
36
110
30

~~Pitch 2.3"~~
~~Diam 18"~~
~~2 Pitch~~
~~Teeth 36~~

~~3.1416~~
~~18~~
~~251328~~
~~31416~~
~~565488~~

Diam 20"
2 Pitch
Teeth 40

3.1416
20
62.8320

Diam 24"
2 Pitch
Teeth 48"

3.1416
48
251328
125664
48) 150.7968
.75

Diam
[redacted] 18"
3.1416

3.14
15
1570
314
47.10
2.3) 56.4 (24
46
104
92

18) 34 (1
18
60

3.1416
18
251328
31416
56.5488

3.1416
16
188496
31416
24) 50.2656 (2.0
48
22

3.1416
14
125664
31416
21) 43.9824

3.1416
15

16
15
80
16
24.0

18
15
90
18
270

15
16
90
15
240

14
15
70
14
21.0

18.25
1.8
600

15
12
30
15
18.0

17.5

15
18
60
15
21.0

600
12
15) 7200 (450
60
120
120

21
15
105
21
12) 315 (26¼
24
75
72
30

3.14
21
314
628
65.94
600
39564.00

3.14
26¼
1884
628
785
82.425
450
4121250
329700
37091250

450) 39564 (87.92
3600
3564
3150
4140
4050
900
900

3.14) 87.92 (28
628
2512
2512

Aug 3, 1880.

3.1416
18
251328
31416
24) 56.5488 (2.356
48
85
72
134
120
148
144

18

23
2.4
92
46
3.1416) 55.2000 (17.5
31416
237840
219912
179280

18) 24.0 (1.3
18
60
54

1.3) 24.0 (18.5
13
110
104
60
65

18.5
1.4
740
185
2590

18) 27.0 (1
18
90

18.2
1.5
900
182
27.

18.5) 26 (1.40
185
750
740
100

15" spur. 1.2 diam. pitch.
18 teeth. 2.6 circum. pitch.
Armature 21" diam. at 600 revs.
with spur of 12"
~~15" : 12" :: 600 : 750 Revs. per min~~
~~with 12 : 15 :: 21 : 26¼ diam of armature.~~

$$\begin{array}{r} 3.14 \\ 15 \\ \hline 1570 \\ 314 \\ \hline 47.10 \end{array}$$

$$\begin{array}{r} 1800 \\ 12 \\ \hline 21600 \end{array}$$

47.10) 21600.0(458.6 revo. to give 1800 ft. circum. velocity per m. in 15" spur.

$$\begin{array}{r} 18840 \\ \hline 2760 \\ 2355 \\ \hline 4050 \\ 3768 \\ \hline 2820 \\ 2826 \end{array}$$

$$\begin{array}{r} 3.14 \\ 21 \\ \hline 314 \\ 628 \\ \hline 65.94 \\ 600 \text{ revo.} \end{array}$$

revo. 458.6) 39564.00(86.27 circum. of Armature to make 458.6 revo.

$$\begin{array}{r} 36688 \\ \hline 28760 \\ 27516 \\ \hline 12440 \\ 9172 \\ \hline 32680 \\ 32102 \end{array}$$

3.14) 86.27(27.4

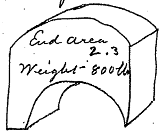
$$\begin{array}{r} 628 \\ \hline 2347 \\ 2198 \\ \hline 1490 \\ 1256 \\ \hline 2340 \end{array}$$

$27\frac{3}{8}$

27 3/8 diam of Armature to make 458.6 revo.

See Book 72 First Series pages 186 to 194. Aug 3, 1880

Motor for Locomotive.

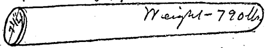


One magnet field.

Weight of
6 = 4800 lbs.

2.3
.77
161
161
1.771
450 lbs.
88550
7084
796.950 lbs.

27" Dynamo.



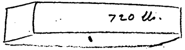
~~2.75~~ $3\frac{9}{12} = \frac{45}{12\times12} = \frac{45}{144}$

144) 45.0 (.3125
432
180
144
360
288
720
720

.3125
.3125
15625
6250
3125
9375
.0976~~5625~~
3.14
3908
977
2931
.3067781/3
1533890
102259
1.536149

1.636
480
130880
6544
785.280

Weight of 6 = 4740 lbs.



Weight of 3 = 2160

3.5 : 5.33 :: 133.7 : 204

6685
446
3.5) 7131 (204

Copper wire on each core
200 lbs.
6 cores = 1200 lbs.
Cores + copper 5940 lbs.

Armature for 20½ magnet weighs 2187. Plates are 20." diam.

Now for 27" diam

$\overline{20}^2 : \overline{27}^2 :: 2187 : 3986$ lbs.

27
27
189
54
729

729
19683
4374
15309
400) 1594323
3986

Weight of armature plates
3400 lbs.

19000
5
95000
10

50
10
500

Suppose copper (300 lbs) is increased
in same ratio.

400 : 729 :: 300

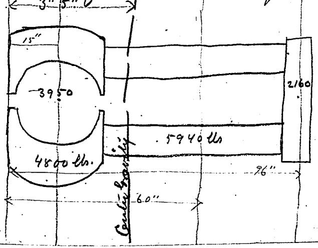
729
300
400) 218700
547

Copper on Armature 550 lbs.

Armature + Copper without shaft 3950 lbs.

Center of Gravity

32
24



64
24
8
96

```
 4800
 3950
 ----
 8750
  .15
 ------
 43750
 8750
 ------
 131250

 4800
 3950
 5940
 2160
 -----
 16850

 131250
 356400
 207360
 ------
 16850)695010(41.
       67400
       -----
        2101
        1685
        ----
        4160

 41 inches = 3 ft 5"

 5940
   60
 ------
 356400

 2160
   96
 -----
 12960
 19440
 ------
 207360
```

See page 113 Revo. per minute of 5 ft driver at 90 miles per hour is 224.2 and at 1800 feet speed of gearing or 21600 inches the circumference of wheel should be

```
224.2)21600.0(96.343 inches on circumference
      20178
      -----
       14220
       13452
       -----
         7680
         6726
         ----
         9540
         8968
         ----
         5720
         4484
         ----
         12360
```

25
1.2
50
25
30.0

3.1416) 96.3436 (30.7 inches
94.248
209560 is diameter
of spur.

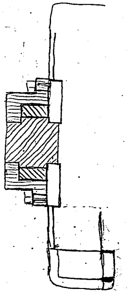
1.2 was diam. pitch of
spur on armature shaft

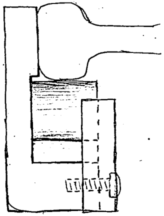
30.7
1.2
36.84

30
1.2
36.0 teeth and
spur on driving wheel
30" diam.

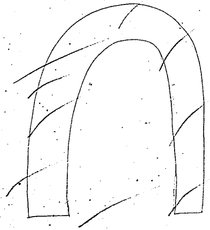
2 550
2 4 675 175
3 7 850 175
2 4 11
350
525
3 5 16 850
125 6 1375
22
7

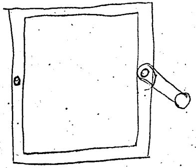
Aug. 1880.
Clutch. Clarke.





Reversing gear for clutch, Clarke, Aug. 9, 1880,





2) 3.1416
1.5708
Length of Inside line 4
5.5708
.02
.111416

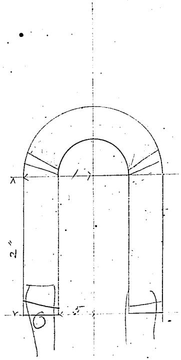
3.1416
4
Length of Outside line 7.1416
.02
.142832

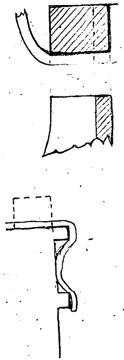
5.5708 : 7.1416 :: .111416

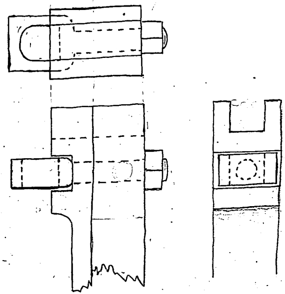
7.1416
.111416
425496
71416
285664
71416
71416
71416
5.5708) .7956 8850 (~~0~~.142
55708
238608
222832
157765

5.5708
.111416
3.14) 5.459384 (1.74
314
2319
2198
1213

7.1416
.142832
3.14) 6.99876 (2.23
628
718
628
907







305733) .00425600000000000137
10.64
.00064
.00425 6 000
305733
1198670
917199
2814710

.000000014 ohm

and if solder be 12 times as great resistance we have .000000014
12
.000000168 ohm. and
for 138 connections 138
1344
504
168
.000023184 ohm

Oct. 4th
Clarke

~~Internal~~

Resistance of conductor of copper .24" × 1" and $\frac{1}{500}$" long.

$R = \frac{10.64\,l}{m}$, where l = length in feet and m = circular mils,

1 circular mil = $.0005^2 \times 3.14$
= .000000785

3.14
.00000025
1570
628
.0000007850

.000000785) .240000000 (305733
2355
4500
3925
5750
5495
2550
2355
1950

There are 305733 circular mils in this section .24 × 1.
Length is .005" or .0004 ft
hence $R = \frac{10.64 \times .0004}{305733} =$

Resistance from solder
.000232 ohm

140
140
5600
140
.31) 19600

33226
44.3

28009118
.0000232
56018236
84027354
56018236
.31) 649.8415376 (2096
62
298
279
191

If resistance be 30 to 1 and internal is .01 ohm. then external is .3 ohm and total .31 ohms. with 140 volts on .31 ohms we have

$\frac{\overline{140}^2}{R} \times 44.3 = 28009118$ ft-lbs.

$= 85$ H.P.

Now of the total 28009118 ft-lbs.

$\frac{.0000232}{.31}$ is due to soldering (sop written above "soldering")

$= 2096$ ft-lbs.

If soldering be $\frac{1}{1000}$ deep instead of $\frac{5}{1000}$. then the loss is 424 ft-lbs

$= \frac{1}{80}$ H.P.

$\frac{1}{40}$

16 48

186° 215°

16

110 Volts

)26.1) 175.0 (6.7
156 6
15 40

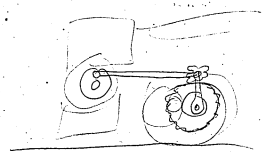
39) 175 (2

6567
.55
32835
32835
3611.85
2278
5890.
71.5
29450
5890
41230
33000) 421.135.0 (12.76 H.P.
33
91
66
251
231
203

.34
6700
23800
204
2278.00

1.43
6700
100100
858
9581.00
6567
1.35
32835
19701
6567
8865.45
9581.
18446
69.5
92230
166014
110676
33000) 1281.997.0 (38.85
99
291
264
279
264
159

38.85
12.76
26.1 H.P.



140
.675
700
980
840
945.00

95 Volts at 950 revs. for $\frac{14}{100}$ machine.

.28 2.8 ohms to circuit

of which 2.52 is Counter E.M.F.

95
95
475
855
9025
44.3
27075
36100
36100
2.8) 399807.5 (140000
28x
119
112

33000
33000
66000

66000) 399807.5 (6
396

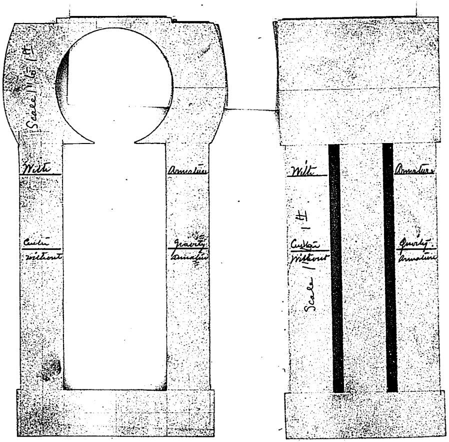
$\frac{9}{10}$ of 140000 = 126000
15000
110000 outside

140000
16000
156000 consumed

156) 110.000 (712
109 2x
150
156
240

~~11 0000~~
~~156 0000~~

[ITEM FOUND IN BOOK]



Menlo Park Notebook #116 [N-80-07-27]

This notebook covers the period July-November 1880. The entries are by Charles L. Clarke. The book contains calculations, notes, and drawings relating to dynamos and steam engines for the jumbo dynamo. There are also tests of dynamos and motors, using meters with depositing plates to measure the current, and tests of the insulation for the electric railroad track. The label on the front cover is marked "C. L. Clarke." The book contains 284 numbered pages.

Blank pages not filmed: 222-257, 262-274, 277.

Missing page numbers: 275-276.

xE-172 N-80-07-27

9 x 10

81
10
510 at 120 developes 100
120
16200
510
97200

3,5 x 8
3,5
175
105
12,25
8
9800
60
588000
5880
294000

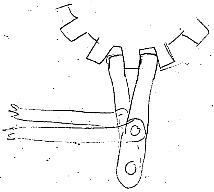
97200
600
58320000

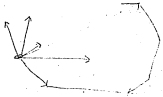
294000
100
58320) 2940000 (5
29160
5
25

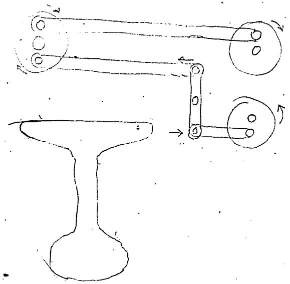
Clarke

Supt. of engineering.
M. Hanes Manhattan -
New York

60
12







30 to 1 Resistance

75 lights

105 Volts at 600 revo.

2 Turns of 8 wires

Wire 87/100

armature

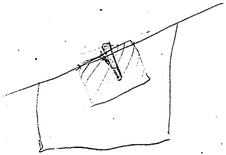
20 " long

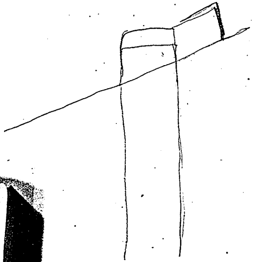
14 " diam.

51 commutators.

Proportions for Dynamo.

July 27, 1880.

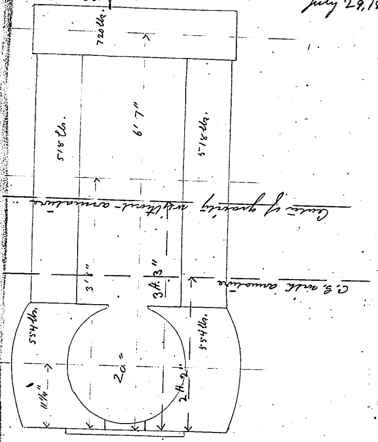




Determining Center of Gravity

20" Dynamo

July 29, 1880.



575
575
1036
42
2072
4144
43512

554
554
1108
11.25
5540
2216
1108
1108
1246500
56880
43512

79
720
1580
553
56880

2864)112857(39"
85927
26937

3' 3"

720
1036
1108
2864

Weight of armature with shaft some 2500 lbs.

11.25
2500
562500
22.50
2812500
112857

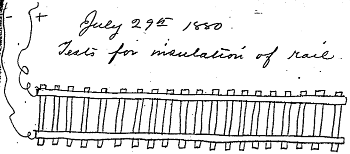
2864
2500
5364

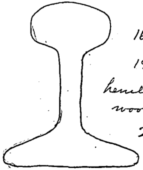
5364)140982(26 inches
107287
33702
32184

2 ft 2".

July 29th 1880.

Tests for insulation of rail.





16 lb. rail.

19 sleepers of hemlock cord-wood.

24 ft. rail.

After being laid down upon a grass plot and spiked and allowed to remain a week, during which time there were heavy rains the resistance was measured. The grass was dry and sky clear. The resistance was 8900 ohms, as the spikes on one side were drawn the resis-tance rapidly increased.
And when all the spikes had been

drawn ~~and~~ on one side and that rail rested on the two end sleepers the resistance was,

290 000

When a man stood on the rail at each sleeper on the end,

220 000

When a middle sleeper was in contact also,

250 000.

When man touched it with his hand it was

100 000

When all the ties on that side were in contact but spikes drawn the resistance was 75000.

Spikes pulled on both sides and rails supported on end ties
and ties not well grounded
1600000.

Man standing on three points of support 16 000

One rail taken off sleeper and laid on ground, other rail supported on ends, and contact points and rail resting on ground wet,

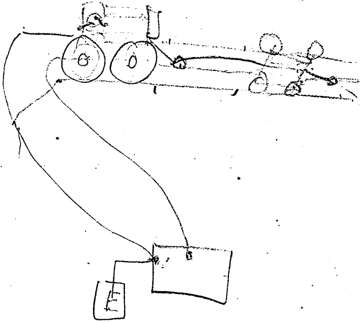
250 000

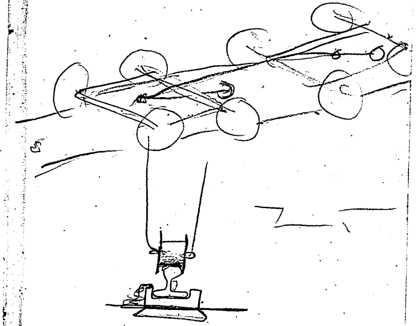
Rail wet on ground and other end of circuit grounded

450

again 100000

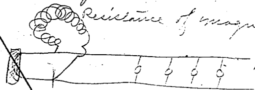
The grounding of the rails is the principal cause of fall in resistance and not directly through the ties as their resistance is very high.





Aug. 7, 1880

Resistance of magnet.



1000 lamps
100 ohms
each

Resistance of magnet 30 to 1

If 1000 lamps are in circuit the resistance of circuit will be $\frac{1}{10}$ ohm, therefore resistance of magnet is 3 ohms.

Then with 100 volts at machine we have

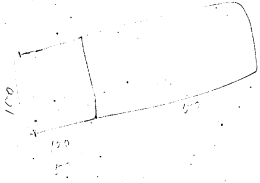
$\frac{1}{3} + \frac{10}{1} = \frac{31}{3}$. Resistance with magnet is $\frac{3}{31}$ ohms.

$\therefore \frac{1}{10} : \frac{3}{31} :: 100 : 96.8$ Volts.

$\frac{300}{31} \times 10$

31)3000(96.8
279
210
186
240

a fall 3.2 Volts



Aug. 7, 1880.

Now supposing only 100 lamps in use.

The resistance of line will be 1 ohm.

$\therefore \frac{1}{3} + 1 = \frac{4}{3}$ ∴ therefore resistance of line including magnet will be $\frac{3}{4}$ ohm.

$\therefore 1 : \frac{3}{4} :: 100 : 75$

a fall of 25 Volts.

If only one lamp is in use, the resistance of line is 100 ohms and including magnet $\frac{300}{103}$ ohms.

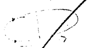
$\therefore 100 : \frac{300}{103} :: 100 : 2.9$

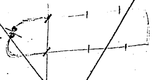
$103)300(2.9$

a fall of 97.1 Volts.

$\frac{1}{2} + \frac{1}{30}$ $\frac{16}{30}$

$\frac{16}{30} : \frac{15}{30} :: 100$





100 lamps. 106

30 to 1 30 to 1

1 ohm 420/106 ohm

1/30 ohm

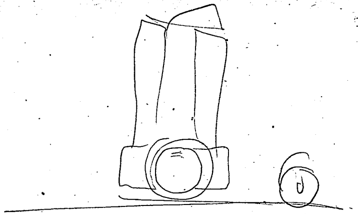
$\frac{100}{106} + \frac{1}{30}$

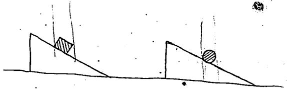
$\frac{31}{30} : \frac{30}{30} :: 100 :$

31) 3000 (96.8
279
210
186
240

3000
106
$\frac{3106}{3180}$, 3180

3180) 310600 (97.
28620
24400
22260
2140

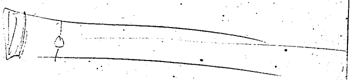


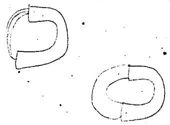


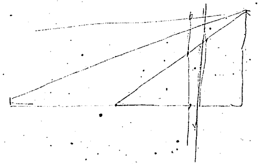
$\frac{100}{106} + \frac{1}{30} = \frac{3000+106}{3180} = \frac{3106}{3180}$

$\frac{3106}{3180} : \frac{3000}{3180}$

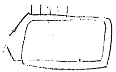
3.106) 300000 (96.6
279544
20460
18636
18240

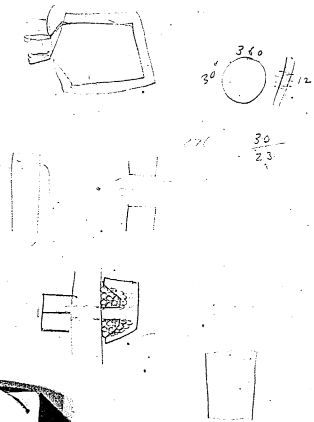






772) 165000 (214
1544
1060
772
2880





Basis Experimental

Aug. 11, 1880.

100 revo. give 8 volts with 75 turns. 19½" armature. 75 commutator blocks.

at 600 revo. 48 volts.

If ~~a~~ armature 3 times as long will give 144 volts.

115 volts will run present lamps. 9 2/10 per H.P.

About 135 volts are required for the machine.

144 : 135 :: 75 com. to 70.3 com.

Since 71 and 73 are prime 69 commutators are taken which will give 132 volts. 23

Calculation for Commutators

Diam. of plate 19.5"

69 turns or 138 divisions.

Circumference of 61.2".

138) 61.20 (.4435

552 x

600

552

480

414

660

4

.444" for each division.

.02" for peg and .02" for insulation

Say .05" for separation.

.444 - .05 = .394" for wire

Diam. of plate 19.5"
69 turns or 138 divisions.
Circumference of 61.2".

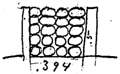
```
138) 61.20 (.4435
     552x
      600
      552
       480
       414
        660
                 4
```

.444" for each division.
.02" for peg and .02" for insulation
Say .05" for separation.
.444 - .05 = .394" for wire

Commercial Wire.

4, 5, 7, 8, 9, 10, 12, 13,
14, 16, 18, 20, 22.

Cross Section of Wire



.009 on each wire for insulation

.394
.036
.358

.5
.045
.455

Actual space occupied by
Copper wire. .358" × .455"

4) .358   .455
.089   .111

Wire 9/100" diam.

or 8100 circular mils.

20 wires give
162,000 circular mils.
in section.

Length of armature
29".
Diam. at center of wire 20".
Allow 5" for ends.
making 29+20+5 = 54" ×2 = 108"
or 9 ft of wire for complete
turn. There are 69 comm.
69 × 9 = 621 ft of wire on
machine, which has resistance
of equivalent size and
1/4 the length or
155.2 ft.

Resistance of mil-foot
10.64 Ohm.

Resistance of machine
= $\frac{10.64 \times 155.2}{162000}$

```
       155.2
       10.64
      ------
      6208
     9312
   1552
162~~000~~) 1.651.328 (.0102
            162 x x
            -------
              313
              324
```

Lamp 165 ohms.

Take 800 lamps

$\frac{165}{800}$ Ohms resistance

800.)165(

.206 Ohm.

A ratio of .206 to .0102

or 20 to 1

at 132 Volts.

2) 3.1416
1.5

.o

$\overline{132}^2 : \overline{115}^2 :: .0102 :$

115
115
575
115
115
13225
.102
26450
13225
17424) 134.8950 (.00774 Ohms.
121968
129270
121968
73020

132
132
264
396
132
17424

.206 : .00774 :: 26.651.

.00774) .20.600 (26.6
1548
5120
4644
4760

Aug. 11. 1880.

Size of commutator block on circle 8¼" diam.

69 Blocks

$$\begin{array}{r} 3.1416 \\ 8.25 \\ \hline 157080 \\ 62832 \\ 251328 \\ \hline 25.918200 \end{array}$$

25.9182 ~~00~~ inches circum.

allow 1/16" insulation

$$\begin{array}{l} 69)\,25.9182\,(.3756 \\ \;\;\;\underline{207} \\ \;\;\;\;\;521 \\ \;\;\;\;\;\underline{483} \\ \;\;\;\;\;\;\;388 \\ \;\;\;\;\;\;\;\underline{345} \\ \;\;\;\;\;\;\;\;\;432 \\ \;\;\;\;\;\;\;\;\;\underline{414} \end{array}$$

$$\tfrac{1}{16} = 16)\,1.00\,(.0625$$

$$\begin{array}{r} 96 \\ \hline 40 \\ 32 \\ \hline 80 \\ 80 \end{array}$$

$$\begin{array}{r} .3756 \\ .0625 \\ \hline .3131 \end{array}$$

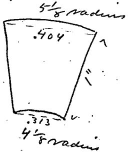
Outside diam. 10¼".

$$\begin{array}{r} 3.1416 \\ 10.25 \\ \hline 157080 \\ 62832 \\ 31416 \\ \hline 32.201400 \end{array}$$

$$69 \overline{)32.201400}(.4667$$

$$\begin{array}{r} 276 \\ \hline 460 \\ 414 \\ \hline 461 \\ 414 \\ \hline 474 \end{array}$$

$$\begin{array}{r} .4667 \\ .0625 \\ \hline .4042 \end{array}$$



3.1416
16
188496
31416
69) 50.2656 (.7285
483
196
138
585
552
336

.729

$6\frac{3}{100} = \frac{37}{500}$

31416
49.5
157080
282744
31416
61.26120

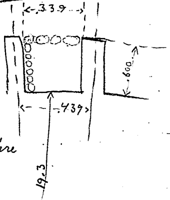
.729
.0625
.6665

Drain

3.1416
19.3
94248
282744
31416
138) 60.63288 (.439
552
543
414
1293
1242

20.5
19.3
2) 1.2
.6

.439
.100
.339



$\frac{7}{100}$ drain of wire

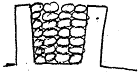
28
4900
25200
112
137200

$$\begin{array}{r} 80 \\ 80 \\ \hline 6400 \end{array} \qquad \begin{array}{r} 28 \\ 6400 \\ \hline 11200 \\ 168 \\ \hline 1792.00 \end{array}$$

If $\frac{9}{100}$ diam. including insulation $9 \times 4 = 36$

$.439 - .36 = .079 = \frac{8}{100}$

separation.



7

$3\frac{17}{32}$

$\frac{4}{7}$

.437

32

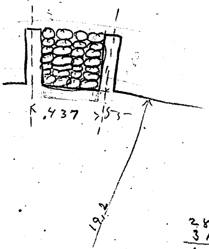
.10

.10

180000

3 × 6

200000



20.5
19.2
2/1.3
.65
.7

3.1416
19.2
62832
282744
31416
60.31872

138 / 60.31872 (.437
552
511
414
978
966

Wires 8/100 diam. or 9/100 with insulation.

.437 - .36 = .077 for separation

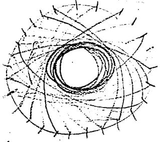
6400
28
6400
11200
168
179.200 Circular mils.

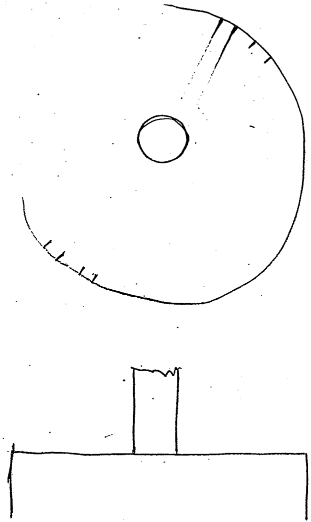
179200 : 162000 :: .0102 :

.0102
162000
204000
612
102
179200) 1652.4000 (.00922
1612 8 4 x
3960
3584
3760

.206 to .00922

or .00922) .20600 (22.
1844 x
2160
1844
3160





$9\frac{1}{4}$
$3\frac{1}{2}$

19) 5.75 (.303
5 7
8 0

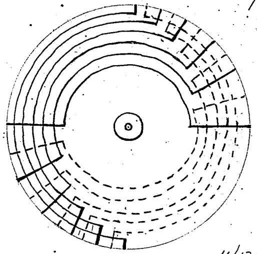
3.5
301

.0625
.031

3.5
.303
3.197
.03125
3.22825

.303
.0625
.2405

Aug 21,
1880.



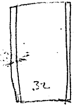
4) 138
$34\frac{1}{2}$

3.1416
~~10~~ $10\frac{1}{4}$
31.4160
7854
32.2014
16.1

$3.1416\frac{1}{2}$
3
94248
15708
2) 10.9956
5.5

20.5
7
13.5
11
24

,433
,32
.113
.11
.013



32) 23.0 (.71875
22.4
60
32
280
256
240
224
160
160

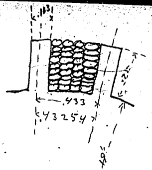
.32
.33

100
75 300
10000
15 0000

3.5
.301
3 199/1000

19) 5.71875 (.301
5.7
18

9 7/32
3 16/32
5 23/32



3.1416
19.
282744
31416
59.6904

138) 59.6904 (.4325
55.2
449
414
350
276
744

113 : 320

433
113

8 / .433 . 75
.4 + .113 . .9 + .03

20.5
19
2/11.5
.75

4 by 9 wire 8/100 " diam. with insulation or 7/100 of copper.

740
4900

36
4900
32400
144
176400

744
690
540
432

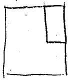
176400 : 162000 :: .0102 :

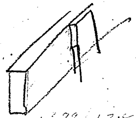
.0102
162000
204000
612
102

176400) 165240 (.0093
158760
6480
5292

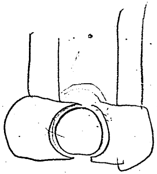
,0093) .2060 (.22
186
200

22.51 with lamps at 165 ohms.





.299).13851(.46
1196
1890



.24).1385(.5
120
18

.24).1385(.58   5/10
1207
155
192

5/8 .62

4)138(69
34½

176400 circular mils

176400(420 diam.
16
82)164
164
1000

1000
1000
1,000,000.

Radius = 21/100

.21
.21
21
42
.0441

3.1416
.0441
31416
125664
125664
.138544 56 sq. inches

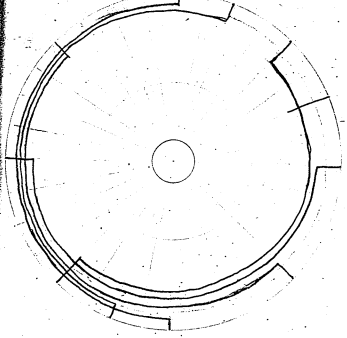
is the end area of each bundle of wire in copper.

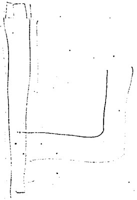
3.1416
6
2)18.8496
34.5)9.4248(.273).1385(.5
6900
2524
2415
1098

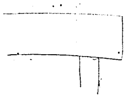
.25).13854(.55
1250
135
125

.5).139(.28
10
39

.525).1385(.22
1260
1350
1350



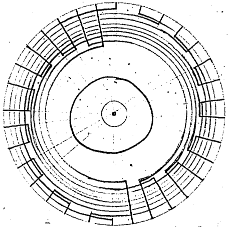




End connections
for armature coils.

Aug. 23, 1880,

Clarke,



1½

34) 5.0 (.147
.08

6

23) 5.6 (.22

6 / 138
23
46

2 / 34
1.7

.25) .13850 (.554
.139

4 / 138
34½

.554

17) 6.00

.3000
.0625
.2375

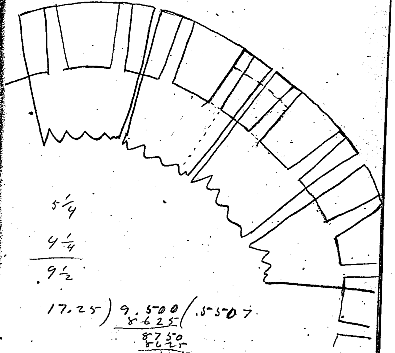
3.45) 6.000 (.17

5.25 : 5.25 + 4.25 :: x : 69

5.25
69
4725
3150
9.5) 362.25 (38.1
285
770
760
105
95

Clarke.

2)138
4)69.
17¼



5¼

4¼

9½

17.25) 9.500 (.5507
8625
8750
8625
12500
12075

1/16 = .5507
.0625
.4882

$3\frac{1}{2}$
$5\frac{3}{4}$
$9\frac{1}{4} - \frac{1}{32}$

$9\frac{8}{32} - \frac{1}{32} = 9\frac{7}{32}$

.0625
18
5000
625
1.1250

$9\frac{7}{32}$
$3\frac{17}{32}$
$5\frac{11}{16}$

19) 5.6875 (.29934
3 8
188
171
177
171
65
57
80
76
40
38

16) 11.0 (.6875

5.6875
1.125
19) 4.5625 (.240
38
36

17) 5.0 (.3

.3) .1385
.46

19) 5.25 (.2763
38
145
133
120
114
60
57

.2763
.0625
.2138 is width of copper rings on 19 side

.2138) .138544 (.65
.128284
10260
10690

The height is .65".

16) 4.25 (.2669
32
105
96
169
140

.2669
.0625
.2044 is width on $15\frac{1}{2}$ side.

.2044) .138544 (.677
122644
15904
14308
15960

The height is .68

4|69
17¼
18} 36
17} 34
18 and 18
17 and 16

18) 5,75 (.32 distance between
5 47
35
36
Centers of strips.

$$\begin{array}{rl} & .32 \\ \frac{1}{16} = & .0625 \\ \hline & .2575 \end{array}$$ is width of

Copper rings on 18 side.

17) 5.75 (.34 distance between
5 1.4
65
68
Centers of strips.

$$\begin{array}{rl} & .34 \\ \frac{1}{16} = & .0625 \\ \hline & .2775 \end{array}$$ is width of

Copper rings on 17 side.

19) 5,75 (.303
57
50.
.0625
.2405

~~.7912~~

.7912
.20
2) .5912

3.1416
21.5
157080
31416
62832

69) 67.5440 (.9789
621 x x
544
483
614
552
620
621

.9789
.0625
.9164

.9789
1.5
48945
9789
2) 1.46835
.73418
.0625
.67168

69) 59.6904 (.8651
552 x x x
449
414
350
345
54

.8651
.0625
.8026

3.1416
20.5
157080
62832

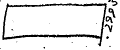
69) 64.4028 (.93337
621 x x x
230
207
232
207
258
207
510

.93337
.0625
.87087

$3\frac{1}{2} + \frac{1}{32}$

$3\frac{16}{32} + \frac{1}{32}$

.236
.0625
.2985



.299342

$9\frac{3}{8}$
2
18.75

3.1416
18.75
157080
219912
251328
31416

69) 58.905 ~~000~~ (.8537
552 x x
370
345
255
207
480
483

.8537
.0625
.7912
.32
2) .4712
.2356

$10\frac{1}{4}$
$\frac{3}{4}$
$9\frac{1}{2}$

5.3506
.0625
6) .47256
.07876
~~.8537~~

.8537
.64
2) .2137
.1019

.7912
.32
2) .4712
.236

.8537
1.5
42685
8537
2) 1.28055
.64028

~~.8537~~
~~.15~~

.64028
.0625
.57778

.64028
.236
.236
1.0625
1.81506

1.81506
1.28
6) .53506
.089

.578
.578

.7912
.0625
.578
.0625
.578
.0625
.7912

2.9159

$32\overline{)17.0}(.53125$
16 0
1 00
96
40
32
80
64
160
160

3.53125
.3615
3.16975

3.53125
.3065
3.22475

.236
.32
.07876
.32
.07876
.32
.07876
.0625
.07876
.32
.07876
.32
.07876
.32
.236

2.92706

.0625
.299
.3615

.0625
.244
.3065

$\frac{5}{8} \times \frac{3}{16} = \frac{15}{128}$

$128\overline{)15.0}(.117$
12 8
2 20
1 28
920
896

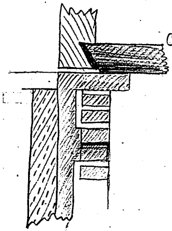
$10\frac{1}{8} =$

10.125
3.1416
607500
10125

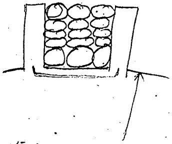
$.117\frac{}{1000}$

Sept. 1, 1882

Commutator Side.
Clarke



Sept. 10, 1880.



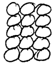
3 × 5

1.5 acres

$\frac{10}{100}$

```
   3.1416
     19.5
  -------
   157080
  282744
  31416.
138)61.2612(.443
    552××
     606
     552
      541
      414
```

.505



```
64)1.00(.015625
    .64
    360
    320
     400
     384
      160
      128
       320
       320
```

$$\begin{array}{r} .015625 \\ 3 \\ \hline .046875 \end{array}$$

$$\begin{array}{r} .5 \\ .046875 \\ \hline .453125 \end{array}$$

$\frac{1}{32}$

$$\begin{array}{r} .047 \\ .4 \\ \hline .5 \\ .447 \\ 2)\overline{.053} \\ )\overline{.026} \end{array}$$

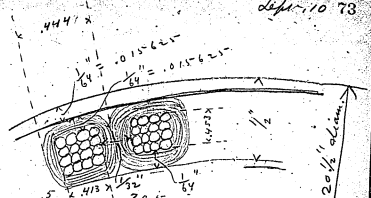
$$\begin{array}{r} .047 \\ .020 \\ .067 \\ .4 \\ \hline .467 \end{array}$$

$$\begin{array}{r} .5 \\ .467 \\ \hline 2)\overline{.033} \\ 3)\overline{.0165} \\ 5 \end{array}$$

36

$\frac{44}{1000} = \frac{22}{100}$

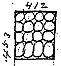
$\frac{1}{4}$



$$\begin{array}{r} .5 \\ .0313 \\ \hline .4687 \end{array} \qquad \begin{array}{r} 20.5 \\ .9374 \\ \hline 19.5126 \end{array} \qquad \begin{array}{r} .4687 \\ .0156 \\ \hline .4531 \end{array}$$

$$\begin{array}{r} 3.1416 \\ 19.5 \\ \hline 157080 \\ 282744 \\ 31416 \\ \hline 138)\overline{61.26120}(.4439 \\ 552 \\ \hline 606 \\ 552 \\ \hline 544 \\ 414 \\ \hline 1272 \\ 1242 \\ \hline 300 \end{array} \qquad \begin{array}{r} .4439 \\ .0313 \\ \hline .4126 \end{array}$$

See page 77.

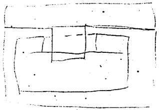


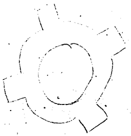
available space for wire.

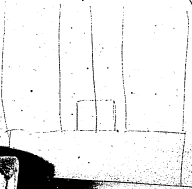
16 wires $\frac{100}{1000}$ diam.

$\overline{100}^2 \times 16 = 160000$ circular mils

Since the wires actually take up .4 in both directions we have .053 in radial and .013 in circumferential

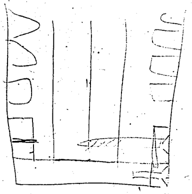


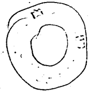


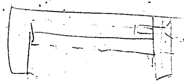


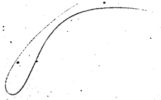
direction for insulation in addition
to what has been already allowed.

.40
.33









.05
.02
.025
.4
.495

.52
.07
.45
.40
.003)0.050
2)17
8

3.1416
19.51
31416
157080
282744
31416
138)61.292616(.444

2).894
.003).022
.7

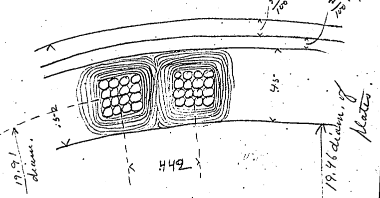
10.25
.495
9.755
19.510

10.25
.72
9.73
19.46

19.46
.75
19.385
3.1416
116310
19385
77540
19385
58155
138)60.899916(441
552
567
552
179

19.46
.45
2)17.91
8.95

wires 1/10 diam.



7 turns of 3/1000 tracing linen will fill up space between bundles. 8 turns will fill up allotted space of .45 radially.

Sept. 10,
1880.
Clarke.

2)19.46
9.73

3.1416
.0025
157080
62832
.00785400
16
47124
7854
.125664 sq. in. is the actual cross-section of copper in the strands in Armature.

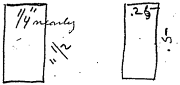
.126 sq. in. of copper.

.25).126(.5
.125

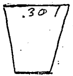
Sept 17, 1880
Clarke

If it is made into solid block 1/2" deep the thickness must be

.50).125664(.25
1004
256
250



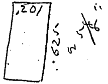
This may be made into a trapezoid



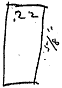
Sept. 17. 1880.

If we allow the depth to be Clarke
$\frac{5}{8}$" = .625" then the width
would be .201

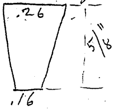
$.625\overline{).125664}(.201$
.1250xx
664
625



We will allow however .22
for width to allow for brazing
and imperfect moulding

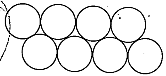


or in the trapezoidal
form

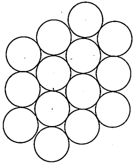


44

$C_{16}H_{20}$.

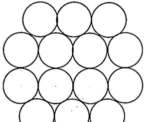


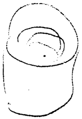
$C_{20}H_{18}$. / n



R. 130.

9:





Sept. 28, 1880.

Experiment on heating of copper rods revolved through the magnetic lines of force.

Temp. of atmosphere at commencement 76.°5 F.
Temp. of Iron Plates of Armature 77°5 F.
Temp. of Fields 81° F.
Time of Commencement 7-27 P.m.
No. revo. per m. 136.
After revolving 10 m. in strong field the temp. still remained 77° F.
Started again at 7-40 p.m.
No. revo. per m. 240
Field strengthened

Temp. of atmosphere remains constant. 76°.5 F.
After running 30 m. no perceptible heat.

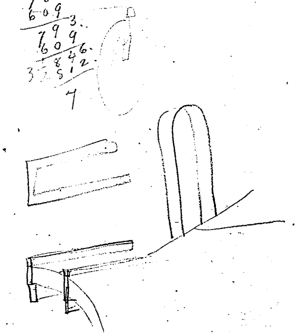
Third test commenced 8-30 P.M.
No. revo. per m. 300.
30 minutes duration of exp.
Copper bar went from 80° to 87.

4th test
Commenced 9-7 P.M.
No. revo. per m. 300.
Duration 1 h.
Temp. at end 88°F.
Temp. of air 76°F.

See page 89

203) 787836 (3334) 33000 (9
30006
609
788
609
3
799
609
6
3 8 4 2
3 5 1 2
7

144



17769
44
71076
71076
78183
6
78783

144
7
137
134
959
311
1376 9

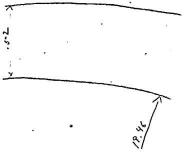
Test-continued Sept. 29, 1880 Clarke,

Wednesday.

Temp. of air	77° F.
Time	4-30 P.M.
Temp. of copper rods	78° F.
Revolutions per minute	280.
" second test	310.
3rd "	310
Temp. of copper rods after 1 hour	80°F.

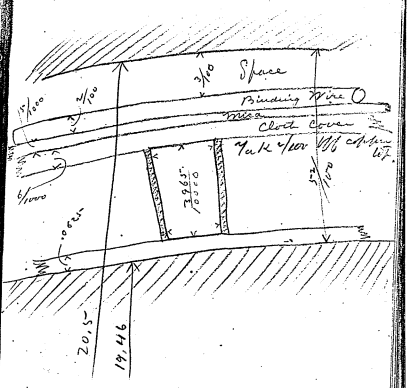
No appreciable rise in temperature was found to have taken place by revolving rods of copper in the magnetic field therefore no injurious local currents and it was decided to adopt rods of large size instead of wires across face of armature.

20.5
1.04
19.46



.03
.025
.006
.3965
.0625

Clarke.

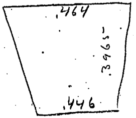


Sept. 30, 1880

Clarke.

```
     19.46
       .793
       .125
   --------
     20.378
     3.1416
   --------
    122268
    20378
   81512
  20378
  61134
  ~~61189~~
138) 64.0193248 ( ~~.4639~~
     552                .464
     ----
      881
      828
      ----
       539
       414
       ----
       125

     19.46
       .125
   --------
     19.585
     3.1416
   --------
    117510
    19585
   78340
  19585
 58755
138) 61.5282360 ( ~~.4459~~
     55.2                .446
     ----
      632
      552
      ----
       808
       690
       ----
       118
```



$$\begin{array}{r} .464 \\ .446 \\ \hline 2\,)\,.910 \\ \hline .455 \end{array} \qquad \begin{array}{r} .3965 \\ .455 \\ \hline 19825 \\ 19825 \\ 15860 \\ \hline .1804075 \end{array}$$ sq. in.

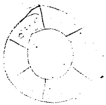
The former made of 16 strands of 1/10 wire had section of .126 sq. in.
So the ratios of resistance will be 126 : 180

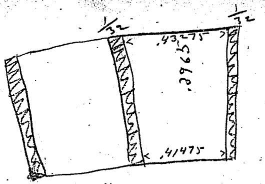
$\frac{126}{180} = \frac{63}{90} = \frac{6}{9} = \frac{2}{3}$

but take out insulation and

2

,02
,01





$\frac{1}{16} = .0625$

$\frac{1}{32} = .03125$

,464 − .03125 = .43275
,446 − .03125 = .41475

```
 2)  .8475
     .42375
     .3965
    -------
     211875
    254250
   381375
  127125
 ----------
  .168016875
```

Therefore 126 : 168

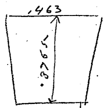
$\frac{126}{168} = \frac{63}{84} = \frac{9}{12} = \frac{3}{4}$

.21638

92 See next page

```
.3965
.0200
.3765
```

```
.3965
.02
.0625
.006
.003
.02
.03
.5400
```



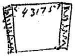
Take off .02 from top of
Copper rods

19.46

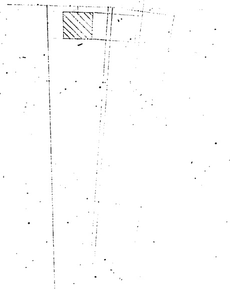
```
  19.46
    .125
    .753
  ------
  20.338
  3.1416
  ------
  122028
  20338
 81352
20338
61014
  ---------
138)63.893 8608 (.463
    552
    ---
     869
     828
     ---
      413
      414
```

.463 less insulation

.463 − .03125 = .43175



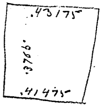
.0625



.43175
.41475
2).84650
.42325
.3765
211625
253950
296275
126975
.1593536 25

126 : 159

$$\frac{126}{159} = \frac{42}{53} = \frac{7}{9}$$

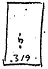


$\frac{1}{16} = .0625$

$\frac{1}{32} = .03125$

$\frac{5}{32} = .15625$

$\frac{7}{8} = .87$



If we assume depth to be half an inch at ends then

.5) .159353625
.31870725 will be the average width

.31870725
.15625
.16246725

163
156
.319

Assume average width to be $\frac{3}{16} = .1875$ we have

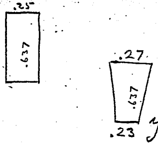
.1875) .159353625 (.85
15 0 0 0
9353
9375

Assume average width to be $\frac{1}{4} = .25$

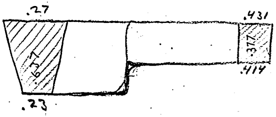
.25) .159353625 (.6374
150
93
185
175
108

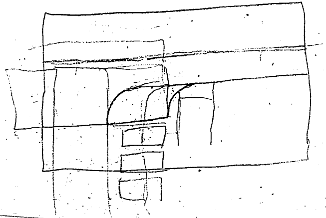
The height will be .6374

Then



This is actual dimension to which block is to be made at ends.



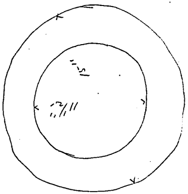


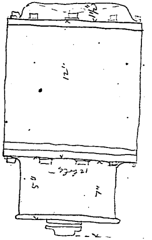
```
    3,1416
     19,46
    188496
   125664
  282744
  31416
138 ) 61.1355536 ( ,443
      552xx
       593
       552
        415
        414

     3,1416
       20,5
     157080
    62832
138 ) 64,402880 ( ,466
      552xT
       920          1132
       828
        922

5/8 = .625
       .24
      2500
     1250.
    .15000
```

```
     ,431
     ,414
2 / .845
    ,14225
       377
     29575
   29575
  12675
 .1592825
```




1½"
12"
5"
7"

120 H.P. dynamo   Nov. 18, 1880.

at 600 revolutions gives

132 Volts, see page 23.

If another magnet is added and only 450 revolutions the E.M.F. will be

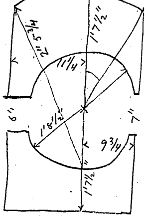
$$132 \times \frac{4}{3} \times \frac{450}{600} = 132 \text{ Volts.}$$

B

Calculations for Buckeye Engine.

The engine to run at 450 which is 3/4 of 600 revs. for Porter Engines.
Masses of iron to be made 1/3 larger.

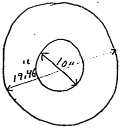
Clarkes Nov. 19, 1880.



1st
100 H.P.
Constructed for Porter Engine at 600 revs.

When drawn to a scale of 3" to one foot the length of magnets on the face is 7 inches.
The end area is 14.3 sq. in for upper field + 14.9 sq. in for lower field,
Total is 29.2 sqr. inches.
The contents will be
$29.2 \times 7 = 204.4$ cu. inches.

Clarke.
Nov. 19
1880.



The diameter of the armature core is 19".46 and hole.. 10" diam.
The end area will be

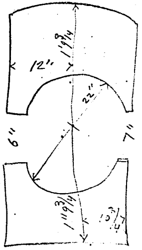
```
  19.46
  19.46
  11676
  7784
17514
1946
378.6916
100.
278.7
```

```
4)278.7
   69.7
   3.14
   2788
   697
   209.1
X  218.858 sq. in
   28
```

And contents

```
  1750864
  437716
X 6128.024 cu. in
```

The Dynamo for the Clarke Buckeye Engine. Nov. 19. 1880.

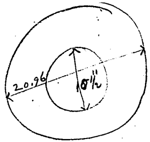


Area of upper field 17.7 sq. in.
+ Area of lower field 18.7 sq. in.
Total 36.4 sq. in. of end area
on a scale of 3" to 1 ft.
If the magnets are 32"
long on the face the contents
will be 36.4 × 8 = 291.2 inches

Compare this with contents on page 117, 291.2 − 204.4 = 86.8

Then $\frac{868}{2560}$, about 1 & 3, which is the desired proportion _

22
1.04
20.96



The outside diameter of armature core will be 22" − 1.04 = 20".96 And suppose it necessary to increase the shaft from 4 1/2 to 5", which will make the hole 10 1/2" diam.

The end area will be

$$439 - 110 = \frac{4 \times 329}{82{,}25 \times 3{,}14}$$

$= 25{,}8$ sq. in. and if 32" long, $25{,}8 \times 32 =$

8256 cu. inches

Compare with page 119.

$8256 - 6128 = 2128$

$$\frac{2128}{6128} = 1 \text{ to } 3$$ which is the desired proportion.

22.
20.968
1.032
.516

20.50
19.46
1.04
.52

21.03
20.968
2|.062

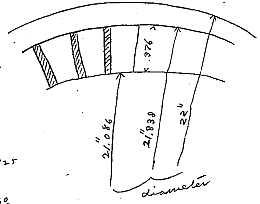
20.5
19.46
1.04

22.086
.914

Clarke, Nov. 19, 1880.

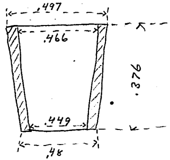
22.162
21.838

21.838
.752
21.086



32)1.000(.03125
96
40
32
80
64
160
160

21.838
3.1416
131028
21838
87352
21838
65514
138)68.6062608(.497
552
1340
1242
986
966



21.086
3.1416
126516
21086
84344
21086
63258
138)66.2437776(.48
552
1104
1104

497
.03125
.46575

497
.03125
.46575

48
.03125
.44875
.46575
.91450

.15886
.02227
.1515

.4575) .18150 (397
13725
44250
41175
30750

2/.9145
.4575
.376
27450
32025
13725
.1720200 sq. in. is the

end area of the copper rods across the face of armature.

.431
.414
2/.845
.4225
.376
25350
29575
12675
.1588600 sq. in. is the end area of copper rods for Porter Allen Dynamo.

.172
.158
14

.14) 158 (11
14
18

the ~~resistance~~ area is ~~diminished~~ increased by $\frac{1}{11}$ but the length of rod is increased by $\frac{1}{7}$. ~~and the~~

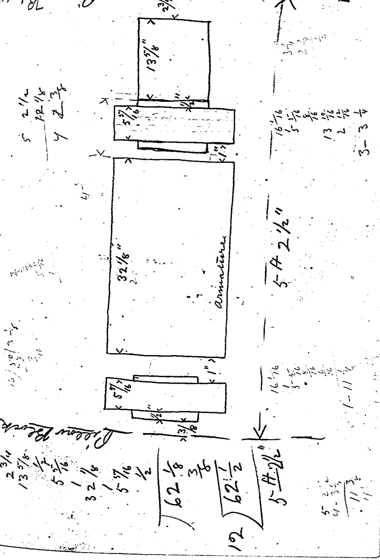
$\frac{4}{28}$

To make the area increase in same proportion as length or $\frac{1}{7}$ th the end area must be $\frac{8}{7}$ of .15886 sq. in. =
.1815 sq. in. and to have same circumferential dimensions to copper rods, their depth must be
.1815 ÷ .45 75 = .397 inches.
which brings the face of the core on armature
.397 - .376 = .021 inches
farther away from face of field than with Porter-Allen Dynamo.

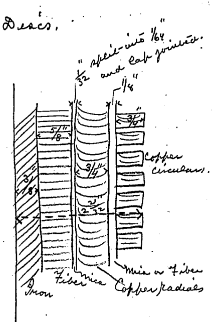
See page 209
for revised dimensions

Weight of sleeve for Buckeye dynamo as per bill of lading 325 lbs.

Nov. 20, 1880. Clarke.



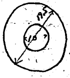
Details of Discs.



Entire width of disc
5 5/16".

$$\begin{array}{r} 3/4 \\ 1/8 \\ 3/4 \\ 1/32 \\ 5/8 \\ 3/8 \\ \hline 2\ 21/32 \\ 2 \\ \hline 5\ 5/16'' \end{array}$$

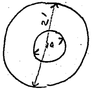
Dec. 6, 1880.
Clarke.



28" long

The weight of the plates of this armature (Porter-Allen Engine at 600 revs.) is 1600 lbs.

The commutator weighs 164 lbs.



32" long

The weight of the plates of the armature for the Buckeye Engine at 450 revs. will be, as calculated from above data; 2300 lbs.

The copper disc weigh approximately 800 lbs. altogether.

Dec. 6, 1880.

Clarke.

Outside this armature there will be 138 copper rods, approximately 34" long and .1815 sq. in. end area (page 131). the contents will be

$$\begin{array}{r} .1815 \\ 34 \\ \hline 7260 \\ 5445 \\ \hline 6.1710 \\ 138 \\ \hline 493680 \\ 185130 \\ 61710 \\ \hline 851.598 \end{array}$$ cu. inches

= 270 lbs. of copper on the face of the armature!

1.6) 1.08 (.675 volts to 1 degree
96
120
112
80

1.08) 1.60 (1.48
108
520 degrees.
432 to 1 volt
880
864
120

40
1.96
240
40
640

40) 64 (1.06

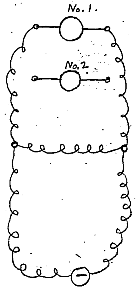
3) 40 / 3 / 44(120

$\frac{3}{2} \div \frac{2}{1}$ $\frac{6}{2}$

$\frac{3}{2}$ 1.

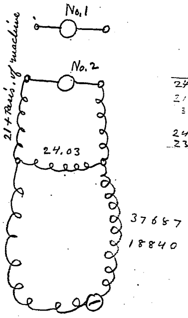
Clarke

Test for Motors. Dec. 7



37687
21
37708 + x

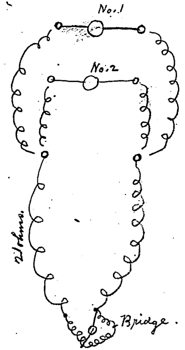
.18840
21
18861



19.96
2.02
1.02
.45
.35
.14
.09
24.03
21
3.03

24.03
23.70
.33

W. A.



The resistance was not perceptibly increased by the wires leading to machines. Total Resis. outside machines 21 ohms.

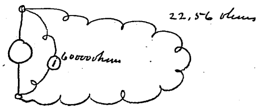
1,48
90
133,20

.675) 90,000(133,333
675
2250
2025
2250
2025

Dec. 8. 1880.

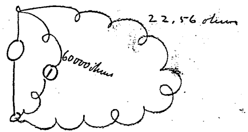
Clarke:

No. 1



N. G.

No. 2



Each machine $\frac{14}{100}$ ohms

No. 1 (965 revolutions.
134° deflection. and .675 Volts
-- 5 1°.

No. 2 (965 revolutions.
136° deflection

675) 110000 (163.
6750
4250
4050
2000
201

Second observation

No. 10 { 965 revolutions.
138° deflection.

No. 9 { 965 revolutions.
139° deflection

No. 10, as a dynamo,
No. 9, as a motor,
Resistance only that of
the machines and ~~sho~~
Short No. 10 leading wires.

No. 10 (Revolution 965.
Deflection 135°

No. 9 (Revolu 886.
N. G.

No. 10 as motor
No. 9. as dynamo

No 10 (Revolutions 938

No 9 (Revo. 965
Deflection 139°

N. G.

Field Increased.

No. 10 (Revo. 953
Defl. 147°

No. 9 (Revo. 945
Defl. 150°

22.56 ohms outside.

No. 10 as dynamo
No. 9 as motor.

No 10 (Revo. 947
Defl. 145° & 146°

No 9 (Revo. 850

N. G.

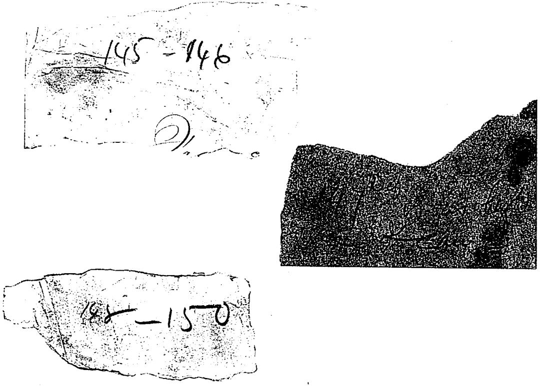
No. 9 as dynamo.
No. 10 as motor.

No. 9 (Revo. 881
Defl. 148°–150.

No. 10 (Revo. 932

N. G.

[ITEM FOUND IN BOOK]



[ITEM FOUND IN BOOK]

× 44.3 = 16500

16500
33000
33000
363000

5
44
1666
21105

24) .700 (.03
.72
60
180

Dec. 18th 1885

965 Revolutions   Clarke

Field and E.M.F.

Def. on Magnet.	Def. in Line.
0 Magnet No. 10.	18 — 18
0	28 — 28
1	40 — 40
2	57 — 52
3	63 — 63
3.5	74 — 74
5	89 89
8	107 107
10	119 119
11	130 130
16	140 140
22	145 145
32	155 155
68	170 — 170

The deflection is 64° for 40 Standard Daniell Cells.

965 revolutions.

Magnet:	Machine.
~~Magn~~	12 12
0 Magnet No. 5.	20 20
1	32 - 31
2	
3	40 - 40
2	50 50
4	59 - 60
5	70 70
5.5	85 85
7	105 105
	122, 122
11	131 131
14	138 138
17	142 142
19	150 150
30 - 31 -65	165 166

The deflection is 64° for 40 Standard Daniels Cells.

Dec, 13, 1880.

Weight of Copper depositing plates before action of current.

No. 1 —	109.100 gms.
No. 2 —	111.385 gms.
No. 3 —	109.190 gms.
No. 4 —	130.195 gms.

Resistance of leading wires .356 ohms.

Resis. of Magnet No. 5 without leading wires 1.76 - .356 = 1.404

Resis of No. 10 without leading wires 1.865 - .356 = 1.509

Resis of armature in No. 5 without leading wires .507 - .356 = .141

.862
.517
.345
.125
.986

Dec. 14. 1880.

Resistance of armature in machine No. 10 - without leading wires.

.507 - .356 = .141

New test.

Leading wires .348 ohms.

Resis. of depositing cells. Two in series.
Plates 1 & 2 - 3 & 4
together .865 - .348 = .517 ohm

Total resistance of circuit including depositing cells and machines.

1.21 - .348 = .862

72

Clarke,

Deflection in high resis-
tance galvanometer direct
in circuit of machine
No. 10. 140°

No. 10. the dynamo –
No. 5. the motor
Speed of motor 895
Speed of dynamo 940

Circuit passed through
depositing cells at 3.53 P.M.

Deflection between terminals
of dynamo No. 10 140°
Deflection between
terminals of motor No. 5, 139°

26.649 : 140 :: 25.927 : -

```
              25.927
                 140
           ---------
           1037080
           25927
26649 ) 3629780 (137
        26649
        -----
         96488
         79947
         -----
         165410

26.649
  .722
25.927

              26.067
                 140
           ---------
           1042680
           26067
26649 ) 3649380 (137
        26649
        -----
         98448
         79947
         -----
         185010
```


Speed of dynamo
at 3.56 — 940 revs.
Speed of motor
at 4.02
720 revs.

Circuit broken at ~~7~~.03
Run 10 minutes

Weight of copper depositing plates after test.

No. 1	108.320 gms.
No. 2	112.088 gms.
No. 3	109.899 gms.
No. 4	129.410 gms.

$x - a$

$y - a$

$x - a$

$y - a - b - c$

$y - a$

M weighs more than $x - a$

$M - x + a$

N weighs less than $y - a$

$y - a - N$

$\frac{M - x + a + y - a - N}{2}$

780
785
703
709
4) 2977
.74425

$\bar{1}.8717188$
$\bar{1}.2893660$
$\bar{0}.5823528$

.000324556
.194736

$\bar{1}.8488047$
$\bar{1}.2893660$
0.5594387

703
685
.018

703) 18.00 (

703) 700 00 (

697) 3

No. 2 – Weight after exp. 112.088
" " before exp. 111.385

Deposited in 10 minutes. .703 gr.

No. 1 – Weight before exp. 109.100
" " after 108.320

Taken off in 10 minutes. .780 gr.

No. 3 – Weight after exp. 109.899
" " before exp. 109.190

Deposited in 10 minutes .709 gr.

No. 4 – Weight before exp. 130.195
" " after exp. 129.410

.785 gr.

Assume the true amount of deposited copper to be the mean we have

$$\frac{.703 + .780 + .709 + .785}{4} = .74425$$

265.27 : 264.4 :: 940

264
940
10560
2376
265) 248160 (93
2385
960
795
1650

.000325
600
.0000102
31.75

.675
140
27000
675
94.500

26.65
.862
25.788

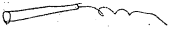
)94.5

1.9734318
1.5497510
2.4236808

1.8450980
1.2953471
0.5497509

26.65 : 25.75 :: 940 265.27
.862
264.408

24.862
.862
24.



The weber of current deposits
.000325 × 60 × 10 = .1947 gms.
in 10 minutes, The total current
is therefore

.74425 3,8225
.1947) ~~3.5765~~

Current = 3,8225 Webers.
Total Equivalent Resis = 94.5 ÷ 3.8225 = 24.722
The E.M.F. is outside dynamo.
Outside dynamo 140 × .675 = 94.5 Volts

94.5	1.9754318
	2
	3.9508636
44.3	1.6464037
	5.5972673
24.722	1.3930790
16003 ft. lbs.	4.2041883

Energy in line outside the dynamo.

Tests Dec. 15. 1880.

Weight of depositing plates before test

No. 1	108.320 gms.
No. 2	112.~~085~~ .078* gms.
No. 3	109.899 gms.
No. 4	129.410 gms.

To see if the free H_2SO_4 in the solution dissolves the plates; a plate is immersed in that solution

Immersed at	12.50 P.M.
Weight before	27.9883 gms.
Taken out at	1.55 P.M.
Weight after	27.9847 gms

An apparent loss of 0.0036 gms.

* The weight was brought to this by exp. page 175.

Plate No. 2
immersed at 2.40 P.M.

Weight before 112.088 gms.

taken out a 5. P.M.

Weight after 112.078 gms.

Lost in 2h.20m 0.010 gms.

The loss for 10 minutes, which was the duration of the test, could not be detected with the balance.

Dec. 16, 1880.

Clarke.

Test of Motor and dynamo.

Weights of depositing plates before the test.

No. 1	108.320 grms.
No. 2	112.078 grm
No. 3	109.899 grms
No. 4	129.410 grms.

These plates were multiple-arcid, 1 + 2 ; 3 + 4 in same cell.

The dynamo was magnet — No. 1. Armature No. with resistance of $\frac{55}{100}$ ohm.

The motor was magnet — No. Armature No. with resistance of .14 ohm. Drove a fan blast.

675
243
2025
2700
1350
164025

875
675
4375
6125
5250
590625

262
675
1310
1834
1572
176850
834

The deflection between terminals of Magnet No. 1 was

$8^\circ\frac{1}{2}$ — 9° = $8^\circ\frac{3}{4}$ = 5.9 Volts

.675 Volt to 1°.

The motor magnet being in every respect like No. 1 must have had the same E.M.F. at the terminals.

Deflection between terminals of dynamo when doing no work 243°. 164 Volts.

Current turned through depositing cells at 3-36 P.M.
Current turned off at 3-43 P.M.
Duration 7 minutes -

134° 142° 135°

1,832
.951
2,783

.915
1.995
2,910

.675
134 1/2
2700
2025
675 337
90.87

The deflection outside the dynamo and depositing cells was 134° — 135° = 134.5°

The deflection between the terminals of dynamo was 142.°

Weight of plates after experiment.

No. 1	106.488 gms.
No. 2	112.993 gms
No. 3	110.850 gms
No. 4	127.415 gms

No. 1	108.320
"	106.488
Increase	1.832 gms.
No. 2	112.993
"	112.078
decrease	.915 gms
No. 3	110.850
"	109.899
Increase	.951 gms.
No. 4	129.410
"	127.415
decrease	1.995 gms.

33000) 151500 (4.6
132000
195000

Take the average as the true amount —

$$\begin{array}{r} 1.832 \\ .915 \\ .951 \\ 1.995 \\ \hline 2\,)\,5.693 \\ \hline 2.8465 \end{array}$$

2.8465 gms in 7 m.

The deposit for seven minutes per weber current is

.000325 × 60 × 7 .13650 gms.

The current was therefore

log. 2.8465	0.4543112
log. .1365	$\bar{1}$.1351327
	1.3191785
20.85	

Current = 20.85 webers.

The total E.M.F. was 164 Volts

E.M.F. × C × 44.3 = Energy

log. 20.85	1.3191785
	2.2148438
log. 164	1.6464037
	5.1804260
151500	

Energy total 151500 ft. lbs.

= 4.6 horse power.

Total Volts / Current $\frac{164}{20.85}$ = Resis.

log. 164 2,2148438
log. 20,85 ~~1,3191785~~
7.8644 0,8956653

Resis. = 7.8644

The total volts are 164 but when the current was flowing the volts at the terminals of dynamo were 95.85, showing that there had been a fall of 68.15 on .55 ohm. This fall disagrees with the fall on the total 7.86 ohms and there must have been much polarization.

The test is on the whole unreliable.

164
875
.535) 69.00 (107
535
400

4.6
52
92
230
164) 2394.2 (1.45
1.64
750
656
940

5.1) 1.10 (.216
1.02
80
51
290

6/9

If 164 Volts are given by the dynamo of $\frac{55}{100}$ ohms at 950 revs, the motor of $\frac{84}{100}$ ohms will give 82 Volts at 950 but as its speed was 600 the Counter E.M.F. is

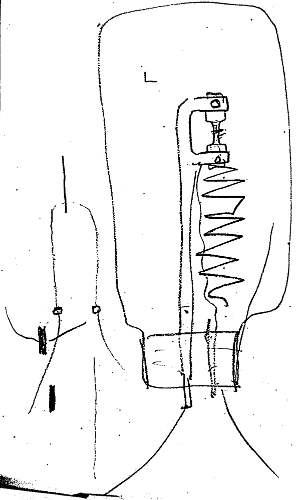
$x : 600 :: 82 : 950$

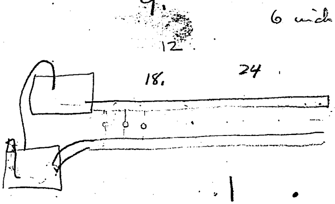
$$\begin{array}{r} 600 \\ 950)\overline{49200}(52. \\ 4750 \\ \hline 1700 \end{array}$$

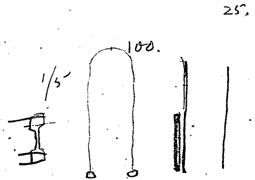
Counter E.M.F. = 52 Volts, then of the total energy on the line or 4.6 horse-power $\frac{52}{164}$ of 4.6 or 1.45 H.P. is developed by motor and as it takes .35 H.P. to run the ~~dynamo~~ motor at that speed the useful effect is

1.1 Horse-power,

so that some 5.1 H.P. are consumed in all and the ratio of useful effect is 21.6%.




9.
6 inch
12
18.
24


25.
100.
1/5

14/10

82
82
164
656
6724
44.3
817 2
26896.
26896
1,4) 29667 3.2 / 211900
28
16
14
26
14
127
126

33 ~~000~~) 212 ~~900~~ (6
208
4

Let a $\frac{14}{100}$ armature gives 82 volts at 950 revs.

The resistance with an equal motor will be $\frac{28}{100}$ but if we wish $\frac{8}{10}$ conversion the total resistance must be 1.4 ohms and we have

$$\frac{82^2}{1.4} \times 44.3 = 211.900 \text{ ft. lbs.}$$
$$= 6.1 \text{ H.P.}$$

but 1/2 H.P. is consumed in friction and local currents leaving 5.6 H.P. but total 6.1 + .5 = 6.6.

6.6) 5.6.0 (.8
5.2.8
320

Test - Saturday Dec. 18, 1880,
Clarke,

Weight of Copper plates before test.

No. 1	96,878 gms.
No. 2	99,461 gms,
No. 3	84,177 gms.
No. 4	113,695 gms.
No. 5.	117,745 gms.
No. 6	117.818 gms.
No. 7	119.145 gms.
No. 8	120.455 gms.

With cells in
Speed of dynamos 935 revs.
Speed of motor 1500 revs.

3 dynamos $\frac{14}{100}$.
1 motor $\frac{14}{100}$.

Time current was thrown through depositing cells
8-55 a.m.

.675
.145
3275
2700
675
97.775

.675
2.45
3375
2700
350
165.375

.675
.148
5400
2700
675
99900

935
3
2805

2805) 15700 (.56
14025
16750
16830

.675
248
5400
2700
1350
167.400

Time current was thrown
out 9-05 a.m.
Duration of test 10 minutes.

Deflection at terminals
of motor with cells in 245-0
.675 Volts to 1°. 165.38 Volts

Weight of copper plates
after test

No. 1	95,891 gms.
No. 2	98,590 gms.
No. 3	84,943 gms.
No. 4	114,580 gms.
No. 5	118,531 gms.
No. 6	118,862 gms.
No. 7	118.047 gms.
No. 8	1.19,528 gms

From 344 - 546 an upward motion
of the fluid noticed.

 ~~935~~

100 Volts at ~~1000~~ revs.
for dynamo.

Suppose motor at 600 revs.
then counter E.M.F. is 60 volts
dynamo 1 unit of work at ~~1000~~ unit
~~speed at 1000~~ ~~revs~~, strain = 1
- motor does $\frac{3}{5}$ unit but at $\frac{3}{5}$ speed
and strain is $\frac{3}{5} \times \frac{5}{3} = \frac{15}{15} = 1$

Suppose two dynamos
200 Volts
The two do 1 unit at unit speed
and $\frac{1}{2}$ strain on each belt
motor does $\frac{3}{10}$ work but at
$\frac{3}{5}$ speed and unit strain is
$\frac{3}{10} \times \frac{5}{3} = \frac{1}{2}$.

Suppose three dynamos
300 Volts,
The three do 1 unit at unit speed
and $\frac{1}{3}$ strain on each belt.
motor does $\frac{1}{5}$ work but at
$\frac{3}{5}$ speed and unit strain
$\frac{1}{5} \times \frac{5}{3} = \frac{1}{3}$. $\frac{4}{5}$ work

Suppose 800 revs
80 volts

---

with cells writ. Speed of dynamos 935 revs
Speed of motor 1570 revs

Deflection at terminals of motor with cells out, 2480
or 167.4 Volts

Change of weight in plates.

No. 1	lost		.987 gms.
No. 2		1.858	.871 gms.
No. 7			1.098 gms.
No. 8		2.025	.927 gms.
No. 3	gained		.766 gms.
No. 4		1.651	.885 gms.
No. 5			.786 gms.
No. 6		1.830	1.044 gms.

1.858
2.025 — 3.883
1.651
1.830 — 3.481
.402
2) 7.364

Average 3.682 gms. in ten minutes.

16500
49500

.167

.179

145210
49500
194710

110330.0 (.56
97355.0
129760 0

unit work

$\frac{1}{3}$ obtain in each belt

$\frac{4}{15}$ work at $\frac{4}{5}$ speed

$\frac{4}{15} \times \frac{5}{4} = \frac{1}{3}$

138550
136330
2220
888 0
14 8.745

136330
8880
145210) 136330 (.9.4.644
1306890
56410

18.911
.14
18911
2.64754

The deposit per weber of current for 10 minutes is

.0003 2456 × 60 × 10 = .1947

log. 3.682 0.5660838
log. 18.911 $\bar{1}$.2893660
1.2767178

Current = 18.911 webers.

Volts. log. 165.38 2.2184830
log. 18.911 1.2767178
log. 44.3 1.6464037
13855.0 5.1416045

Energy developed in motor
13855.01 ft. lbs.

Volts log. 165.38 2.2184830
log. 18.911 1.2767178
8.745 0.9417652

Resistance in motor
8.745 ohms – but .14 only
is true resistance the rest

n dynamos , 1 motor
E volts , e volts
nE volts , $\frac{e}{E}$ Speed
$\frac{1}{n}$ = strain on dynamo belt
$\frac{e}{nE}$ = work by motor
but work is done at $\frac{e}{E}$ speed
Strain on motor = $\frac{\text{Work by motor}}{\text{Speed}}$

$$'' \quad = \frac{\frac{e}{nE}}{\frac{e}{E}} = \frac{1}{n}$$

$\frac{935}{2805}$ 3

1500

being due to counter E.M.F.

x : 138550 ft. lbs. :: 8.605 : 8.745

log	138550	5.1416045
log	8.605	0.9347509
		6.0763554
log	8.745	0.9417652
	136330	5.1345902

Consumed in work by motor 136330 ft. lbs.

~~This is at a speed of 1500 revo. and the drag is therefore in the ratio of $\frac{136330}{1500}$, Each dynamo has this same drag per revolution and there being 3 at 935 revo. we have total work in dynamo drag $\frac{136330}{1500} \times 3 \times 935 =$~~ . The field in dynamos were not in same conditions as in motor.

2805) 15000 (5
14025
15

165
1950

33000) 304440 (9,2
297
70

138550
6813
145363

254940
136330
118610

16500
150
825000
16500
2475000 (26000
95) 247
190
570
570

(33

198520) 536910 (27
397040
1398700
1389640

304440) 11033000 (362
913320
1899800
1826640
73160

log 136330 5.1345902
935 2.9708116
3 0.4771213

8.5825231
1500 3.1760913
254940 5.4064318

Drag on dynamos

254940 ft. lbs.

By previous expts the dynamo at 935 revs take in friction ½ H.P.

∴ 254940 + 49500

= 304440 ft. lbs.

= 9.2 H.P.

= total energy expended,

The motor at same ratio will take at 1500 revs

$\frac{150}{95}$ of 16500 = 26000

The useful effect of motor will be 136330 − 26000

= 110330 ft. lbs.

or ~~36~~% = 3⅓ H.P. useful.

57%

94.20

72) 5086800 (70000

162.74

15704 (104.7 Volts at 965 revs.

.675) 104.7 (155° = deflection.

94.5
1500

965) 141750 (146.9

965) 150375 (155

165.3

Deflection at terminals of dynamos - 2390,

At 965 revs. a $\frac{14}{100}$ machine gives 94.5 Volts and at 1500 we have

94.5
1500
47250 0
945
965) 141750 (146.9

at 1500 = 146.9 Volts

This then was the counter E.M.F. at that speed.

165.38
2.64
162.74 Counter E.M.F.

155.35
1500
935) 233025 (24800

21.838
3.1416
131028
21838
87352
21838
65514

138)68.6062608(.497
552
1340
1242
986
966
202

27
23
50

466
445
2914
457
397
3199
4113
1371
25)18142 9(.725
175
64
50
142

21.044
3.1416
126264
21044
84176
21044
63132

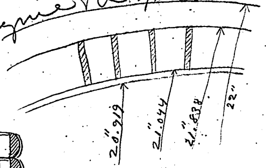
132)66.1118304(.479
552
1091
966
125
1242

32)1.00000(.03125
96
40
32
80
64
160

497
03125
4657.5

479
03125
4477.5

Buckeye Dec 31, 1880.
Engine & Dynamo



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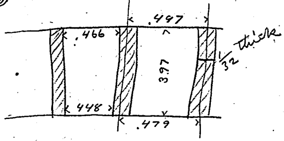
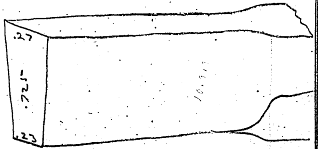
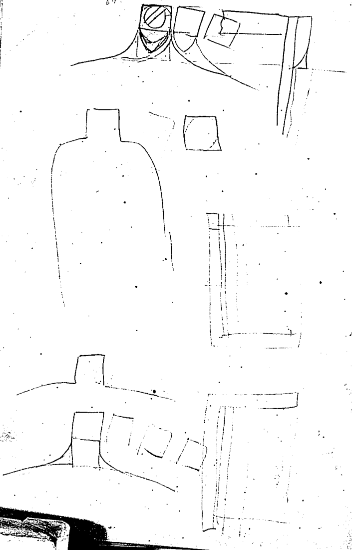


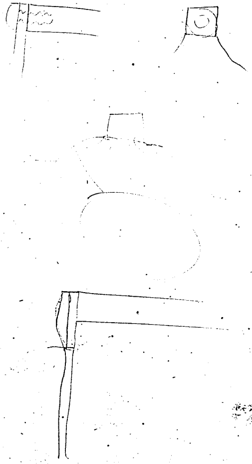


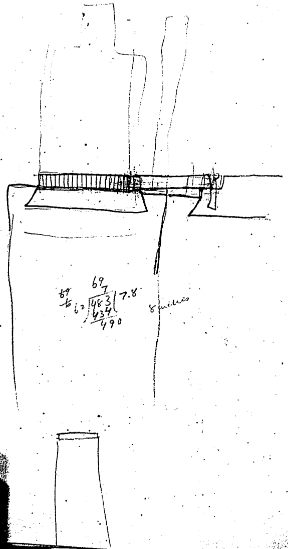
$\frac{1}{16} = .0625$

$\frac{1}{64} = .015625$



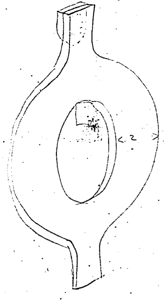
4
1
5
65
45
20
64) 34 … 15½
32
250





69
-6
62 | 483 | 7.8
69
7
434
490

8 inches



 Clarke Jan. 7. 1880

For dynamo $m\mathcal{S} + nE^2 + EC$

but EC is the total energy of induction developed in the circuit and if D is the armature drag we have

$$DS = EC$$

For motor field in same condition

$$eC - ms - ne^2$$

but drag is same as in dynamo

$$Ds = eC$$

For ratio of work by motor to total work

$$r = \frac{eC - m's - ne^2}{EC + m\mathcal{S} + nE^2} \text{ or}$$

$$r = \frac{Ds - m's - ne^2}{D\mathcal{S} + m\mathcal{S} + nE^2}$$

In differentiating $m\mathcal{S}$ and nE^2 are constant also $\mathcal{S}$

now e varies as s $\quad e = bs$

therefore

$$\frac{E'(E - E')}{R}$$

~~$W = E^2 - EE'$~~

~~$dW = 2EdE -$~~

$W = EE' - E'^2$

$dW = EdE' - 2E'dE'$

$$\frac{dW}{dE'} = E - 2E' = 0$$

$$E' = \frac{E}{2}$$

$$r = \frac{Ds - ms - nb^2s}{D\mathcal{S} + m\mathcal{S} + nE^2}$$

$m\mathcal{S}$, nE^2, $\mathcal{S}$, m, and nb^2 are constants under differentiating.

$$dr = \frac{\mathcal{S}dD + Dds - mds - nb^2ds}{\mathcal{S}dD}$$

~~$dr = 1$~~

$dr\,\mathcal{S}dD = \mathcal{S}dD + Dds - mds - nb^2ds$

$\mathcal{S}dD(dr - 1) = ds(D - m - nb^2)$

25 lamps of 125 ohms.

$\frac{14}{100}$ ohms machine

deflection at terminals of machine with one light of 16 candles = 168°

Total deflection

```
    125.19
     168
  ---------
   10011.2
   75084
 12514
125)21023.52(168.19
    125
    ---
     852
     750
     ----
     1023
     1000
     ----
      235
      125
      ----
      1102
      1105
```

Total 168°,19

With 25 lamps on the external resistance is 5 ohms and deflection at terminals of machine

```
     168°,19
           5
5,14)840.95(163°.61
     514
     ----
     3269
     3084
     ----
      1855
      1542
      ----
       3130
       3084
       ----
        460
```

Suppose 8 lamps of 125 ohms total external resistance is 15.625 ohms and with 168° deflection at terminals of machine the total E.M.F. is

```
        15.765
         168
       -------
       126120
       94590
      15765
15.625)2648.520(169.5 volts
       15625
       ------
       108602
        93750
       ------
        148520
        140625
        ------
          78950
          78125
```

Now if the total E.M.F. be 169°.5 Volts and 24 lights be thrown in the deflection circuit, is 5.208 ohms. and deflection at terminals is

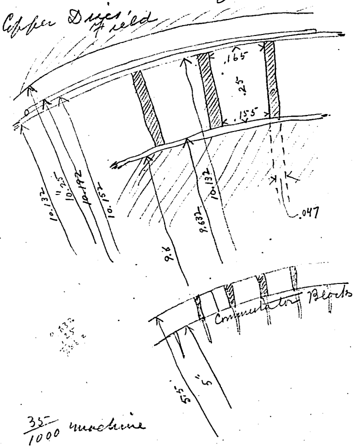
```
       169°.5
       5.208
      -------
      13560
     3390
    8475
5.348) 882756 (165°.1
       5348
       34795
       32088
        27076
        26740
          3360
```

```
  168°
  165°.1
  ------
    2°.9
```

```
   .675
    2.9
   -----
   6075
  1350
  -----
  19575
```

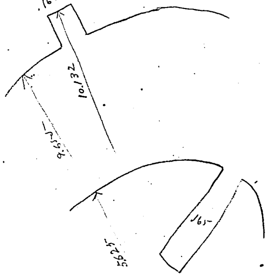
19

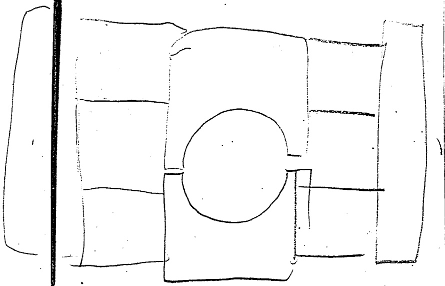
Clarke Jan. 19, 1880

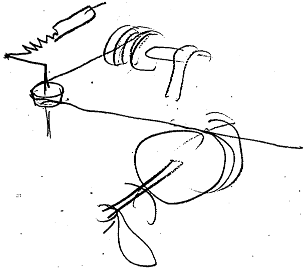


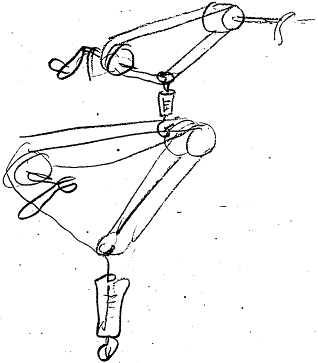
35/1000 machine

Copper Discs. Jan. 19, 1880.









$x - a$

$y - a$

$\therefore$

$M > x - a$

$N < y - a$

$$\frac{M - x \cancel{+N} + y - N}{2}$$

$$\frac{M - x \cancel{+a} + y \cancel{-a} - N}{2}$$

130
30
900
3
900

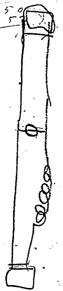
130
130
3900
130
16900

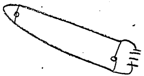
15
.08
1.38

67600
67600

1.28) 748.67.900 √5,849,004
640
1086
1024
627
512
1150
1150

33) 5849000 (17.7
234
231
239

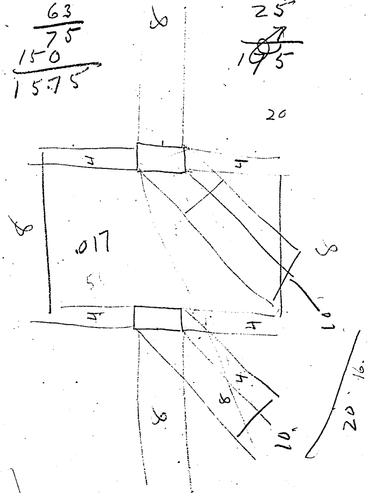




130
130
3900
130
16900
67600
67600
743,600

25
63
75
150
15.75

17
8
25
~~7~~
195

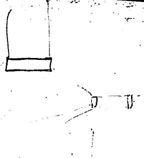


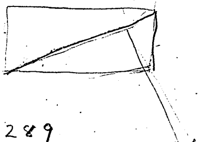
Face 8
Sides 17
Average ~~1~~5.75
17.7

$$R = \frac{10.64\,l}{m}$$

$30 \times 30 = 900$

$900)\,10.64\,(.012$
900
1640
$.012)\,.140$
12





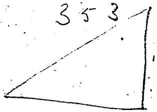
18.8

17
8

289
64
353

289
444

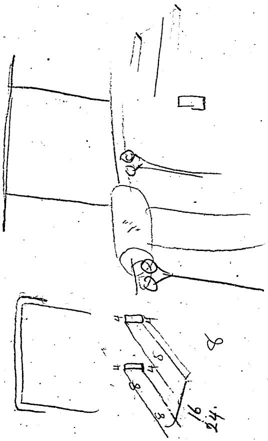
64
32



12

12

5.7
17.7



Menlo Park Notebook #117 [N-80-07-10], Cat. 968

This notebook covers the period July 1880-January 1881 and contains 283 numbered pages. It is the second of two journals kept by Charles P. Mott, which record daily activities at the Menlo Park laboratory (see also Menlo Park Notebook #53). There are also six pocket notebooks that were probably used to record these daily activities prior to their being entered, sometimes in expanded form, into the larger notebooks (see Pocket Notebooks). The first journal begins approximately one month before the earliest extant pocket notebook. However, the last pocket notebook contains entries for the period January-March 1881, which are not found in the journals. Some of the entries in the journals are cross-referenced to the experimental notebooks. Together, these books provide a narrative record of the last active year of the Menlo Park laboratory up to the time that Edison moved to New York City.

Blank pages not filmed: 1.

Lamp posts. A number of large turned lamp posts after a design by Mr. Kruesi were received this morning. they are designed for the large fancy globes and will be in at conspicuous points.

Palmetto Lamp. was examined on the pump and tested. Resistance cold 483 ohms hot 300 ohms and at 17 candles gave 9.6 per horse power.

Bamboo. cut from top or outside edge of fan. Resistance cold 188 ohms at 16°c. 114 ohms and gave 8.6 per horse power. Book 104 page 26 &c.

Black Hills. Miner here with rich ore and tailings from the Black hills and reports plenty of the latter to be had there almost for the carting of it out of the way

Pump. Holzer called my attention to a pump he had recently made and which had been tried by Geo. Hill. it differs from

the other only in having three contractions in the drop tube instead of one as in the other. He claims that the additional contractions act as valves and prevent any air from returning after it has been started down the tube and carried below the second contraction. Hill claims the pump to work very quickly and fast.

Thrust bearing Logan today cut end off of Armature shaft preparatory to putting on a thrust bearings for screw gear motor.

Work general on each was Mr Batchelor, Force and Ott principally on clamp machine the former a little on captive balloon. Smith and one or two assistants on Magnetic brake. Logan and Martin on gear of electric locomotive. Several at Lamp Factory. Gang on R.R. and on Conductors Dean finishing up wood Miller Clair Holmes on 5½ hundred pumps. Flammer & Van Cleve on experimental carbons Upton & Clarke still absent

Monday July 12.

Bamboo: A bamboo lamp tested Saturday was put at 44 candles this morning got very blue at clamp and lasted 1 hour 15 minutes.

Interference evidence in Interference case with Maxim, on use of platinum in electric light, is being taken to day.

Armature. Another armature in the first machine was singularly burned out to day. One trip on Rail Road had been made and no apparent diminution of current at time of shutting off near Depot. but when connection was made for another trip no current was on and a short blow on the whistle indicated trouble inside. On examination the wires were found unburnt, but the solder at commutator had melted. and thus thrown out the machine

Lamp Factory. All wires for Power &c. were run to and connected at Lamp Factory. Telephonic communication opened between there and Mr. Griffin's office. A couple tin men putting up the pipes for the Root Blower which was taken apart and cleaned and adjusted by Cunningham. Moffett cutting out the bottom of pump frames to admit the back part of gauge slide and has one hundred of the pumps mounted and ready for rubber tube connections.

Double Lamp & Holder — Mott today made Patent Office drawings of the double lamps and holders for the same from sketches made by Mr. Edison same general principle of Lamp &c mentioned under date of June 18 and as originally sketched in Book No 63 page 167 &c. The P.O. drawings represent the globe Lamp instead of tubes which were found impractical.

Circuit changer. Francis is fixing up an arrangement for rapidly changing the current for the purpose of experimenting on lamps ~~with~~ reversing the current which heats them. He provided a conducting ferrule. sawed from one side about 3/4 of an inch from the end, in to about the center, near the opposite end sawed in the same way but from the opposite side. These two cuts are then connected by another cut ~~connecting the two first cuts~~ in such manner that the ferrule is divided in two parts, insulated from each other but ~~overlaping~~ interlacing in such manner that a brush contacting with it, connects first on one side and then on opposite side as the ferrule is revolved on a stick to which it is secured, and which is rapidly revolved by an electro motor. using four brushes on the ferrule. two on the central split part and one on each solid end, reversing the current with rapidity dependant on revolving speed of ferrule 

July 12 (continued)

Captive baloon. The other evening Mr. E. had the current of small dynamo turned onto the motor with which the baloon experiments were being made and burned out the commutator. Mr. Batchelor has to day finished a new motor more powerful than the other and secured to it the same wheel previously used. the dynamo current was again applied and the wheel revolved with fearful rapidity all standing well back expecting to see the wheel fly to pieces by centrifugal force. The motor was placed on the scales, and indicated a lifting power of [illegible] pounds.

Visitor Mr. [illegible] and others interested in Mason interference.

Tuesday July 13. 80

Lamp made with fine platina wires secured on the leading wires in imitation of carbon lamp made [illegible] am informed for observations on the deposit of carbon.

Current changer. Tried on a lamp this evening it made the lamp flicker badly and did not prolong its life at least it broke as soon if not sooner than when permanent current has been used.

Captive Baloon. Mr. Batchelor secured on the motor of captive baloon in place of the air wheel, four palm leaf fans. ~~for~~ and lifted six ounces. Afterwards removed two and lifted fourteen ozs And by removing the two further from the center by metallic arms was able to lift 17 ounces. The fans may be set at such angle as will give a fine motion to the air and make a neat and desirable apparatus to combine with electric light system for ventilation or keeping air in room in agitation.

July 13 (continued)

R.R. track tested by Mr. Upton and found to be badly grounded about two times as near as I can guess from figures in Book No. 103, page 113.

Wood Miller. Dean put several blocks in new wood miller and for the first effort found it to work very nicely, the knives only requiring to sharpen and finer edge.

Coal dust. Masons commenced laying the walls for the furnace for burning coal dust.

Carbons. Messrs Edison and Batchelor made descriptive list of solutions and their manner of being applied to carbons, or material before carbonization. Book No. 105 page 21 &c.

Bamboo Lamb. Carbon split separating it into four distinct fibres. Never before observed in a carbon in breaking.

Returned. Mr. Upton from his trip east with family.

Wednesday July 14.

Pumps. Four hundred and eighty pumps using up all suitable tubing in stock, were finished up this morning, having been the principle work of the glass blowers since May 7. or very nearly three months. An average of about five pumps per day for two expert and part of the time two assistant glass workers.

Calorimeter & Galvanometer. Tests have been to day by Mr. Upton on lamps with [illegible] saturated with different solutions. One bast lamp run on reversing current lasted nine minutes. Another run on reversing current burned 1 hr. 41 m. above. Book No. 103, page 121 &c. & 103 p 141.

Visitors. Mr. Babcock of Babcock & Wilcox with a couple friends, probably to observe the progress &c of the dust burning furnace the design of which is by that firm. Mr. Edison suggested to him to experiment on light weight high pressure boilers. probably for aerial navigation experiments.

Carbonization. Some vault carbons having the ends painted with solution of double chloride Ammonia and Platinum. were carbonized by Mr. Batchelor and Van Cleve. Lamps Nos. 260 to 270 with inclosed are of carbons thus treated. Books No. 105 page 23 &c & No 07, page 155 &c.

Bamboo Bradley is getting out some Bamboo fibres with ends 1/16 by .020 with incandescing part same as regular .012 by .012. finds them very difficult to get out from the former and tools now used for the regular.

Yellow Jacket. A Photograph of the shafts &c of the Yellow Jacket Mine showing the levels and distance the pumps for removing the water have to be worked was received. and Messrs Edison Honig and Batchelor are discussing the means and adv &c. of applying dynamo motors for the working of pumps for deep mining.

Ore Separation. Dr. Moses had Andrus make a shoot or small sluice box about one foot wide and three or three and one half long with bottom covered with glass. for experiments on the separation of ores suggested by Mr. Edison. he then procured two pieces of copper tubing perforated with a line of fine holes. and by forcing water through them ~~and~~ permitting the water to flow down over the glass which is set at an incline he has shown some very nice work in washing the Arcadia ores

R.R. grade. At noon to day some of the boys were trying the flat car on the hill to gulley and made a trip or two successfully but finally when starting from the top. the brake chain broke and the boys unloaded themselves except Hickman who was thrown when the car jumped the track and was pretty well

July 15.

bruised and the brake of car broken and bent up. otherwise the car was not injured.

Loops. Mr. Batchelor is to day painting the ends of some Bamboo loops before carbonization, to be sure through the furnace but once.

Bamboo Former. Mr. Batchelor sketched shape and dimensions of Bamboo loops and figured the shrinkage of carbonization to be 20 %. Book No. 102 p21. Andrus is making the former in which to carbonize the Bamboo allowing for the 20 % shrinkage

Conductors. The gang that have been at work on laying the conductors to the Street lamps since May 1. got them all down to day. but there is still a large amount of it to tar, cover and fill trenches. This job has taken Two & one half months ~~for~~ with an average of about a force of six men, in the work

July 15.

Gas Works. Gas apparatus for works at Lamp Factory was received from Rahway and put in position. at work progressing rapidly on gas and air fixtures for the glass blowers.

Visitors Gen. Palmer with Mr. Painter also the European Telephone man Sir

Mr. Clarke also returned from his vacation trip having been absent since July 2?

Pay day. Last weeks Pay day was for some reason continued over until to day

Lamp Factory. Douglass Pump for well or cistern received and delivered there this morning.

Track. The rails of Electric Rail Road were raised and tarred felt put under one rail and tar under the other for insulation. Men are working at it from depot out.

Conductors. to Street Lamps were to day tested by Mr. Upton. Book No 103, pages 145 to 155. 18 wire circuit, wire to wire 55 ohms Ground 25 & 43 ohms. 25 wire circuit South wire to wire 1.4 ground 4.2 and 8.2. Six wire circuit wire to wire 61.8 ground 25.6 & 50.5 Edison line wire to wire 1.6 ohms and ground 5.8 and 9.4 ohms. It will be seen that some of the circuits are very badly insulated and all more or less defective. Men have been set at work uncovering parts of the trench of 25 wire circuit and removing

the dirt from around the lamp posts. After the boxes had been raised out of the ground at low wet points it was tested but with same results. It seems a little strange that unexperienced men should be permitted to put down nearly five miles of wire and cover it without being required to test a single circuit or wire until the entire work is finished and it will now require considerable extra labor and delay in putting the circuits in working order.

Wood Miller. Dean got wood milling machine cutting the loops of .010 diameter beautifully and calipering evenly all the way around and was preparing the saw for cutting them off when Mr. Edison, admitting the perfection of the machine, directed him to clean it up, take it apart and put away, as at present the fibres were an improvement on the wood and the machine would not be required

unless at some future time. this Machine was commenced about June 11. and is so complete in all its 226 parts or pieces and so perfect in working that it ~~seems a pity to have it~~ should deserve a place amongst the ~~go into~~ the archives, rather than be in all probability carried off piece by piece.

[illegible] machine [illegible] completed [illegible] material. [illegible]

Carbonization Mr. Batchelor treated some carbons by dipping the ends in hot syrup and some in an alcoholic solution of syrup and had them re-carbonized. the syrup collected in globules but was carefully removed by Mr. Edison.

Visitors A large party of french gentlemen also one of the London Telephone men and a man with model for rail road. sent by Gen Butler from Lowell Mass.

Absentees. Mr Clarke gone to Philadelphia to note progress and hurry work on the Porter Allen Engine

Armature. Force finished an armature with same amount and quantity of wire but wound and connected in such way as to give .55 ohms resistance instead of about one seventh of an ohm as ~~most~~ the others have

Absentees. Crosby and Lawson were heard from to day, in the western mining regions as representing themselves from T. A. Edison's Laboratory, perfectly familiar with his mining processes and applying ~~for~~ to Bosses for mines or tailings to work.

Bamboo. Carbon of Bamboo with slight notch cut in one side set burning at about forty candles in about five minutes the clamp on one side melted down forming a globule on the end of the wire, and destroying the carbon. Lamp Number 1277. Book No. 57 page 159.

Blow Pipe on ores } Dr. Moses experimenting on metals with blow pipe showed to day that in using sheet iron coated with carbon from lamp flame, and metals such as zinc, tin, lead &c. in connection with soda, placed thereon and subjected to flame by blow pipe, each metal had its own peculiar characteristic of the colors or shades deposited on the carbon in the immediate surrounding of the metal. All of which he claims as entirely new and original.

Street Lamp conductors } Men at work all day on the 25-wire circuit removing the soil from around the posts and uncovering the boxes in many places, but late this after noon when tested by Mr. Upton no improvement or change was found to have been effected. And as Mr. Howell to whom this work had been entrusted seems ready and more than willing to take advice, and listen to suggestions

that if taken in time might have saved him the annoyance of having made a partial failure, and would surely have saved Mr. Edison the extra expense of redoing this work.

Work general in Park works. Men at work at Gas and Air works and fixtures at Lamp Factory. Men finished the preliminary laying of the conductors to Street Lamps. Dean finished wood Miller. took it apart and put away. Gear of electric locomotive about finished. Mr. Batchelor again interesting himself in experimental carbonization. Messrs Edison and Upton experimenting with and testing lamps.

Gas House. Frame raised for gas house at Lamp Factory.

Carbons. Mr. Batchelor pasting Platina foil on the ends of carbons and recarbonizing them the object being to make better contact with the clamps and toughen the ends.

Slotted plates. Yesterday Flammer cut some plates with slots about 1/32 of an inch wide in which to carbonize after the carbons have been treated with a solution or the ends covered with Platina foil.

Captive Baloon. Martin Force prepared one of the sewing machines motors to work two sheet iron fans. 2 ft 9 in long and tapered from 6 1/2 inches wide on inside to 9 inches on the outside and tried it today. Results not very encouraging. The original sketch of the electric baloon will be found on page 55 of Book No. 108 and dated July 9.

Mining. Mr. Edison sketched several devices to be tried in experimenting on the separation of ores by air blast. Book No 108. page 29 &c. and instructed Martin Force to make a box about 2 ft deep, 2 in by 12. and arranged with a perforated 1/4 in pipe on one side of box to give air blast against the sands &c dropping through a small slot in hopper.

Bamboo Fibre. Some "Pure" Bamboo (genuine) was obtained and given to Bradley from which to cut some loops. (The Bamboo previously used was Calcutta Bamboo) The genuine is very fine grained and works nicer than the other.

Tar Insulation. The leakage in the Street lamp conductors was thought to have been caused to some extent by the conductivity of the tar used in the boxes. To test the tar, two copper plates were immersed in a bucket full and tested by Mr. Upton proved to be a good non conductor. Book No 103 page 183. The copper tacks which had been used to secure the wires in the boxes were taken out but made only 5 ohms difference.

Magnetic Separator. Woods. commenced work on the frame for practically working the magnetic separator and on a full & complete working mill to fully test its practicability and commercial value. for mining purposes.

Bast Regular. A regular bast fibre lamp was tested by Mr. Upton. Measuring its resistance as it was brought up gradually (to study the rules governing the fall in the resistance). At 7.8 candles 102.65 ohms. 8.6 candles 103.25 ohms. 9.8 cand. 102.4 ohms. 14 cand. 100.6 ohms. 17.5 candles 99.15 ohms. 44 candles 89.40 ohms. Book No. 103 page 185 &c.

Rail Insulation. Mr. Edison sketched several forms and ideas for insulating the rails for an electric Rail Road which he gave Mr. Clarke with request to draw them out more fully and to add any ideas or suggestions of his own, for trial on the present track, in connection with the insulation already tried and mentioned under date July 10, to determine the best and most economical method of rail insulation.

Visitors. A gentleman connected with the Metropolitan [illegible] RR of London also Clark of the N.Y. Herald.

Track insulation. (Insert note Rail Insu. Appear. page)- Mr. Upton tested the track today the ground and sleepers being very wet from heavy rains. track apart near top of hill. Between rails 5 ohms. disconnected at end of insulated rails about one hundred feet from Station. Tar rail ground 12 ohms. tarred paper under rails and spike heads 124 ohms. Book 137 page 17 &c.

Clamp Machine. Mr Batchelor made sketches and wrote descriptions of a number of improvements on the model to be added to the machine to be made for practical use. Book No. 102 page 23 &c.

Lamp Factory. Six men are at work today caulking the floor under the mercury pumps in the Lamp Factory, the iron reservoir pipes having been taken up to give them a chance to work under the double row of pumps now up. Douglass pump arranged and put in the well.

Small Engine at Lamp Factory together with the boiler were taken out and apart and repaired ready for shipping.

Fibre Formers. Dean is making a pair of formers for cutting out fibre each one is designed only to cut one side or edge and intended to be secured to the bench and drawn and held together by a treadle leaving the operator both hands to adjust and use in cutting the fibre. or one operator can by use of the one former cut the straight edge and pass to second operator to cut the concaved side.

Water. The engine was run during noon time to day to pump the water out of the Pond, and men have been set at work shoveling and drawing out the muck &c. to deepen and give the Pond greater capacity for holding water.

Visitors Goddard & Lowrey with friends. W Miller

Gas Carbonizing furnace received.

Ore Washing. Mr. Edison made several sketches of different apparatuses to be made by Martin Force for experimenting on washing ~~ore &c~~ and other separation of ores. One, of five consecutive planes each a little lower than the preceding one and each plane provided with a rake worked by an eccentric on a counter shaft running parallel with the sluice, and moved back and forward across the plane, down each rake is conducted a flexible rubber hose to convey the water ~~which~~ may be discharged as found, by experiment, to do the most effective work. Another is of a shallow five inch deep tub secured on a frame work in such manner that it may be easily rotated and is given a quick back and forward rotary motion by an eccentric or crank ~~motion~~. Water is conveyed into the tub by hose or pipe, but could not tell from the sketch what style of discharge was intended to be tried. Two others so indefinite in the detail that could not describe them until apparatus made.

Average test on Lamps } From the lamps so far tested at 44 candles, the average life was taken and found to be for Bast 6 minutes. Calcutta Bamboo. 17 minutes and paper about three minutes. The Bamboo carbons were in many cases imperfect which has probably reduced the average for them. but which will be undoubtedly raised when proper precaution and care is used in selecting only perfectly cut and prepared carbons. Book No. 112, page 78c. A paper carbon lamp tested to day at 44 candles lasted 8 minutes and at 13 candles gave 11.5 per horse power. Book No 103, page 29c.

Track insulation. Mr. Edison directed that one hundred feet of track should be insulated by use of hard rubber blocks ⅛ of an inch thick and four inches square, both outside edges to be turned up and over top of rail flange so the spike head would also rest on the rubber, according to the estimated price

of rubber suitable for the purpose the cost per mile of this manner of insulation would be about $176. Mr. Clarke also sketched and described a method for insulating rails in Book No. 115, page 18c. in which he uses a hard wood block fitted to the flange of the rail and extending from the body of the rail to a little beyond the flange. and over this places an angular iron washer bent to fit the wood lap down over the ends and having two strips cut and bent out to enclose the spike and prevent the washer or wood from working out of position.

He is also at present carefully studying up, and searching for data as to the power required and best mechanical means of construction of an electric locomotive for practical heavy freighting use.

Absent Mr. Batchelor went to New York. 11⁴⁰ to see his family off for Europe.

Gear. New man commenced putting the arm and clutch gear on the electric Locomotive.

Reverse current. The motor and cylinder for rapidly reversing the current was adjusted magneto running and fixed up by John Ott. And a ~~ad~~ couple lamps run on the reversing current burned quite steadily the flicker was ~~only~~ perceptible in the lamp but was scarcely noticeable in the light Bamboo at 44 candles lasted 4 minutes and a Bast 20 minutes the Bamboo however was a bad carbon. Book No. 83, page 257.

Magneto calls. A man brought a new design of switch board by Bergmann. Mr. E. liked the design but feared the contact. He also brought a Bergmann and Blake magneto calls. The former worked through 1000 ohms resistance and the latter through 1200 ohms. Also a Edison telephone arranged with a device by

Johnson for the battery call. which appeared very simple and effective but it was not tried

Carbon tester. Mr. Edison suggests that by bending the fibres after they are cut out any unevenness or excess of pith may be detected by the irregularity of the circle and may be thrown out. He also sketched an idea of a bell to be attached to a large Geisler pump. in which one hundred of, or thirty, carbons may be placed and after sufficiently high vacuum may be heated to a red, and irregularities or spots be thus detected. And only the perfect and desirable carbons be placed in the lamps.

Japanese Bamboo Two lamps connected on the pumps

Power to move} Scales were used ~~on the car~~ cars &c. this morning to make dynamometer test of power required to move the motor and cars of the electric road. In starting the open car the scale read 16 pounds. To start open and box car 64 pounds. To keep both running after in motion with current on motor forty lbs. To start engine 86 pounds and to keep up motion 64 pounds.

Japanese Bamboo; Two lamps of Japanese Bamboo were completed and tested this morning. Both carbons were slightly defective and at forty four candles direct current ~~and~~ lasted 15 and one 20 m. Book 103. page 263 &c.

Carbonization. Some loops of white Holly, Turtle wood, Tulip, and Amaranth were cut by Bradley on fibre former, one Amaranth carbon was got out and in the lamp in perfect shape. The wood was very brittle and was soaked in alcohol before bending Book No 57 page 175

Gear Allen are at work putting on the arm and clutch or creeping gear on the electric locomotive.

Track insulation. During the heaviest of the rain and after it had been raining two or three hours Mr. Upton tested the track and found only 4.8 ohms between the rails. (The track was in as unfavorable a condition as in practice it would be by atmospheric influences.)

Water. The heavy rains have stopped all work on cleaning out the pond for the present, as well as all outside work today.

Fibre former. In addition to the lever and trade device for holding the former together (See July 20) Dean has added a frame, worked on a hinge, ~~which~~ ~~made~~ composed of three bars the centre or connecting rod of which may be covered with soft rubber and close down on the fibre to press it evenly in the slot, without the danger of bruising or injuring the fibre.

Papers The New York Herald of Today publishes a long descriptive article on the electric Rail road and its adaptability to the N.Y. Elevated Roads. Daily Graphic Artist [illegible] took some photographs of electric Road & cars.

Rail Insulation. The road was again tested this morning and found to be lower [illegible] between tracks, in comparison with the leakage shown yesterday it would show that the thorough soaking of the under [illegible] of the ties, conducted across more of the current than any amount of [illegible] wet [illegible].

Two rails were laid regularly on sleepers in corner of Laboratory &c. for the purpose of tests and experiments on insulation.

Bamboo Carb. tested at 48 candles and lasted 68 Minutes. the blue in this lamp disappeared after it had been burning a few minutes and did not again return. A Regular Bast was then tested on reverse current and burned 94 Minutes Book No. 112 page 15 &c.

Small Engine from Lamp Factory shipped to Hudson Michigan

Pat. Office Drawings. Mr. Edison sketched several devices and systems for introducing extra wires at different points in a circuit for maintaining the electro motive force. Also two devices for holding carbon loops and for plating the ends with metal. ~~Also~~ a new draughtsman set at work.

Insulating wire. Mr. Clarke made a diagram of a machine for wrapping with strips or other material the cables of the light circuits. It is [illegible] face plate ~~with~~ on a sleeve through which the cable may pass. and the plate having the spools or bobbins of material secured near the perifery. revolves around the cable or wire, it is run by hand with crank and proper gearing and is moved along the wire or the wire may be carried through the machine. It is made to fit varying sized cables by movable or sliding centering rings.

Visitors Fox of Herald also a large party of Ladies who were taken several trips over the road.

Papers. Herald of today also has an article, purporting to be interviews with officers of Elevated Rail Roads of New York on the subject of electric roads concerning their adaptability to elevated roads. Lamp lines. Hickman was set at work on the 25 wire cable, winding it with strips of muslin, preparatory to tarring for better insulation.

Fiber cutter. The fiber holder or clamp for shaping and cutting was tried. The single brace in the center was found to spring the base so it did not close evenly the whole length, and a step piece was cut to bring the bearing near the ends, but it was found that the wooden base then sprung. It was decided to get a cast base and ~~press~~ the clamp together with a double solid right angled lever ~~acting~~ ~~under~~ with the bite coming up in front of the former ~~perpendicularly~~ and the lever arms extending under and back. worked with blades same as before.

Carbonizing Former. Andrews is making a former for carbonizing threads leaving the inside piece loose, instead of riveted as in others, and with a light weight fitted to ~~the~~ press the ends down flat and prevent them from warping or curling out of shape, instead of the ends drawing up they are permanently secured and the loop contracting draws with it the inside piece which at the same time keeps it in symmetrical shape. Mr Batchelor has to day been trying one in which the ends were clamped with light weights which were drawn up as the carbon shrunk, but did not give entire satisfaction.

Oil carbon. A very interesting experiment was made to day by immersing a carbon loop clamped and connected to inner tubes in kerosene oil and brought up to incandescence by the current, bubbles of gas or air were emitted from the carbon in at high heat the oil (assumed a smoky look) appeared to be infused with carbon, On removing the carbon it was found to be considerably

increased in size, greyish in appearance, and perfectly homogenious. It was placed in a lamp, exhausted and burned at 16 candles till 14 minutes when engine was stopped.

Work general Men preparing the gas carbonizing furnace by putting in the gas and blast pipes and fixtures. Clarke on Electric Locomotives Mr. Batchelor on carbons and apparatus for carbonizing. Conductor gang uncovering street lamp circuits. Men finishing up gear for electric locomotive.

Bast Fibres. Two bundles rec'd from Baltimore Md.

Rock Drills. Yesterday Mr. Batchelor at work on Electric Rock drill and devised & sketched several applications of the electric motors for that purpose, using in most cases gear and cam movements, the important one on page 56 of Book No. 102, the drill is connected direct to the revolving armature, and is thereby capable of being run at 2000 or 3000 revolutions per minute and with lateral stroke of probably one half inch imparted to it by a lifting cam, and having a short stroke is capable of acting rapidly, and rather incessantly peeks rather than striking heavy blows. Sketches Book No 102 pages 47 to 59 inclusive.

Kerosene carbons. The experiments with carbons &c in Kerosene oil have been continued to day and the lamp prepared and partially tested on Saturday was put at about 350 candles and lasted 13 min. the resistance was reduced when at that

heat to 7.2 ohms took current of 50 ft pounds per candle or 700 candles per horse power. In this case the resistance was too low to permit of practical sub division of the current. Several attempts were made to deposit the oil carbon on platinum wire but in all cases the accumulation of the gas at one point on the wire caused it to melt and separate in one case however a pretty fair deposit was obtained and under microscope showed very homogeneous; It was given to Dr Haid with directions to attempt the removal of the platinum by dissolution leaving if possible the carbon in exceedingly fine tubular form. In one experiment the glass broke leaving the carbon whole which was examined by Mr Batchelor and found to have increased from .012 to .020 or about four times the bulk. A Bast carbon was then treated by heating hot times in oil and put in Lamp. put at 48 candles. resistance 81.5 ohms took 833

volts and gave 8.75 per H.P., no record that I can learn was kept of its life. Book No. 137 pages 53 &c.

Rail clutch. The friction rail clutch devised for the purpose of electric locomotive was tested today by having one made of wood and tried on the rails. It takes a good firm hold of the rails and has very little back pull before clutching. The only objection being the sliding friction of the forward motion to obviate which Mr Clarke devised and sketched in Book No. 115, page 25 &c one with rollers ~~and the~~ to carry the weight in the forward movement, also to clutch with rollers on an incline.

Blast Pipes. A blast pipe was run into Dr Haid's Room from the box leading to furnace. to be used by Dr in Gas furnace for assaying purposes.

Carbonizing forms with loose center,SUN lined, the ends of the carbons are secured and lightly weighted. and the central piece acts as a weight which is drawn down by the shrinkage of the carbon

which is kept in shape by contracting around the sliding central piece.

Blast Sand exp. Shallow tub making back and forward rotary motion by two eccentric from own shaft and with round pipe perforated on inner side was put in position and air blast connection made ready for trial. was small engine room,

Spark Lamp. A regular lamp had a platinum wire sealed through the globe, on the wire was clamped a short piece of carbonized fibre which extended to within about one half inch of the regular loop. I judge for experiments in attempting to build up carbon loop from the strip carbon by ~~sparking~~ sparking across.

Visitors. A couple Cuban R.R. gentlemen for information on elec R.R. and the cost and rights to uses also Puskas and Friend and Mr. Wilber.

Absent. Sammy Edison left for Fort Gratiot

Spark Lamp. described yesterday was tried to day by connecting the lamp regularly in the circuit in Photometric room and four batteries through the induction coil, connected one wire to one of of the lamp wires and the other connected to the platinum sealed in the globe and to which the carbon strip is clamped, the spark ~~could only be~~ was only perceptible by the "blue" or disintegrated carbon, and that only slightly. The attempt to build up the carbon was to all appearance unsuccessful and the loop broken at that time.

Blast Sand. The Tub device for experimenting on sand separation by air blast, described yesterday was tried today. But ~~not~~ from the blower here sufficient air pressure could not be ~~forced~~ obtained through the small perforations to fully test the apparatus. It was then removed to the other side of laboratory to be tried as a washer, using water in the pipe instead of air.

Carbonization. Mr Batchelor has been to day experimenting with kerosene, Paraphine, and powdered coal, in the moulds, to learn whether the hydrocarbon would form unite with the vegetable carbon similarly to the union derived by the submersion of the loops in kerosene, in all these trials the carbons came out nice and looked very homogeneous. the one in coal powder under the microscope looked as though the small particles of coal had attached itself to the loop. None were tried in lamps to day.

Test Mr Upton made a test of a regular Bast carbon lamp fibre carbonized in new former. At 16 candles 120.15 ohms. 13.5 per horse power, At 48 candles 110.6 ohms and 9.1 per horse power. Lasted at 48 candles 67 minutes Book No 112 page 57 &c. Also made calorimeter test of regular old Bast lamp. Book No 112 page 538 &c

Visitors Prof Barker & friends. Also Mr Young, sent for Prof. the boy car down back - run hard and Journal Herald.

Carbonization. Mr Batchelor is continuing the experiments with kerosene powders and other substances in the moulds during the baking process. No further tests have been made today, in carbons, in lamps. Made tap chemicals in new Number Book No 105 page 13 &c.

Lamp Factory. Schroyder setting in the Lower [illegible] gas pipe and flame frame for glass blowers tables. Hammer bending rubber tube connections between pumps and Mercury pipes.

The motor for power pump was connected up and tried it worked all right and run the pump and sealing but no work was put on the pump.

Ore Separator. Mr Force made the necessary water connections to try the shallow tub ore washer, The preliminary trial worked well enough to warrant removing the apparatus to near small engine room where power may be applied to rotating the tub.

July 28.

Rail Road. Three dynamos were put in series to day and the current applied to the rail road track. The motor was tried and found, when these power and speed seemed to be much easier on the Dynamos inside.

Telephonic. Wires were to day run by Mr. [illegible] from Office to Mr. Insull's Office and telephonic communication opened for purposes of quicker telegraphic communication. Mr. I. proposing to have the tel office in connection with Post office.

Roller clutch. Mr. Clarke completed the details and drawings of roller clutch for locomotive and proposes having wooden model made for testing its efficiency.

Visitors. Another one of the London telephone men

Thursday July 29. 1880

Rails. The rails laid in curves of Saturday last were tested by Mr. Upton and found 8900 ohms between the rails. The [illegible] and mass were then lifted from contact with the rails and [illegible] ohms additional was obtained.

Roller clutch. John Ott ~~is making~~ made a working model from the drawings by Clarke to test its efficiency. The roller one on each side works against inclines and is thrown against the one or the other by an eccentric on top of frame which moves an additional light frame to which are secured four eliptic springs which extend through the frame and have one of their ends bearing on the rollers and by turning the eccentric the springs are made to act to hold the rollers against either of the inclines desired or it may be set so the rollers remain in apex of the inclines and free from the rail head and would first rate and would [illegible] work much better on curves than the same on line

Dynamo Shaft. One of the bearings ~~filled~~ of the Dynamo shaft which had been filled with Babbit metal was found to have worn out and was taken down and refilled with same metal. And a fourth dynamo was put in position and prepared for the test.

Carbon tester. Mr. Edison gave Bohm a tracing of ~~apparatus~~ carbon tester ~~for testing carbons~~ with directions to make the apparatus. It is composed of a large globe connected by tube to four separate pumps which are designed to be kept running to maintain high vacuum in the large globe. to the opposite side of the globe is another tube with stop cock running to a smaller glass globe ~~similar~~ arranged to hold the inner tube and carbon, which is secured therein and made air tight by passing the tube through a rubber ~~stopper~~ and flooding it with mercury similarly to the trap or flooder used on the pumps, the stop cock may then be turned open and it is believed that the large globe will exhaust the air sufficiently from the small

globe to permit of immediate heating sufficiently to note any irregularities,

Carbonization, Mr. Batchelor had a ~~furnace~~ mould made to hold the six inch fibres, and with a 5/8 inch wide sliding center piece, out of which he took some nice carbons, One lamp was made with the 6th carbon and at 16 candles had 188 ohms resistance at 71 candles had 170 ohms resistance and burned 62 minutes, Book 12, page 69 &c. He has been using pipe clay around the lid of the moulds to more perfectly exclude the air,

In the evening Mr. Batchelor drilled in the mould and connected a pipe about two feet long. Some pieces of tissue and [illegible] carbon were put in the mould and in the furnace, at high red heat gas was turned into the mould through the pipe and allowed to burn for awhile. the carbons on being removed were found covered with lamp black or soot, due to too low heat on mould. which was put back and gas turned on at white heat, in this case the carbons were much better and assumed the greyish appearance which indicates the addition of hydrocarbon to the vegetable carbon

Papers. dailys to day have very favorable telegraphic reports from Henderson chief engineer Steamer Columbia, concerning the stability and satisfactory working of the Edison lamps and generators provided for that Steamer

Carbonization. Safety globes were placed ~~on~~ sand and gas flame applied, in the globe was placed some gasoline and the generated gas conducted to one of the moulds in large furnace: in one of the trials the carbon strips came out a beautiful silver grey in middle ones very homogeneous and showing the augmentation by the hydrocarbon of the gas.

A glass chamber was made in which a tube with clamped carbon can be placed and by rubber stopper through which the tube passes made air tight ~~at~~ bottom, in one side of chamber ~~near the~~ bottom is a tube through which the gas may flow and at top is another tube for outflow and burner. the gas from the apparatus used for above experiment was

ignited at outflow tube and the current turned onto the loop, the first experiment the current was kept on at low heat for some time. And the carbon ~~had been~~ was largely increased by the hydro carbon of the gas. the second trial the heat was put very high and put on and off a few times leaving it on but a moment at the time, In this trial a Bart 6 inch carbon was used and came out perfectly even and a blue grey it was taken by Mr B— to the glass house and immediately sealed in a lamp.

Magneto calls. Bergmann and Western Elec: magneto calls. bells were tested by Mr Upton and we ~~preference given to~~ proved best the Western Electric, in the present methods of construction, Book No 137, pages 25-8 &c.

Dust coal. The furnace for burning dust coal is completed and ovens with coke there; The openings or communications are yet to be made ~~with~~ to the boiler fire box—

Kerosene Vapor: A tube or long dust reservoir was sealed to a globe parallel therewith, by a small piece of tubing. In the reservoir was placed about a gill of kerosene, and the opening closed by a flooded rubber stopper. And the whole placed on a pump and exhausted when pretty fair vacuum was obtained the oil appeared to boil, small bubbles coming up through the oil and leaving the surface. When high vacuum was obtained the oil suddenly ceased bubbling, on sealing the lamp off it was tested and found to have collected and formed additional carbon from the oil vapor, and that the resistance hot was but 28 1/2 ohms, took 72.5 volts or 13000 ft lbs at 16 candles, very economical. Book No. 112 page 89 &c. The inside of the globe was also coated with carbon after burning a few minutes.

Wire insulation boys are winding the 25 wire cable with hand twine in addition to the winding and tar already put on.

Drain Pipe. A drain pipe was put down from the small engine house to and connected with the main drain pipe running through the laboratory yard.

Dynamo. A [illegible] dynamo was set running for current to supply the pumps so that R.R. running would not interfere with the work of the pumps.

Night-work. Orders were given by Mr. Edison to run nights and the engine was run till twelve o'clock at night. Mr. Batchelor and several of the men worked all night.

Visitors, Mr. Wilber also Mr. Crede patentee of visual fire alarm indicator and annunciator, of which Mr. Edison expressed high opinion.

Saturday July 31-

Mercury. Sixteen flasks or over 1100 pounds of mercury were received at the Lamp Factory for the vacuum pumps.

Rail insulation. The length of rails in rear of laboratory &c. were insulated to-day, pieces of hard rubber being laid under the rails and strung over the flange, and iron washers placed thereon on which the spike heads would rest. Finished so late that no test was made.

Gas furnace. One of the small square gas furnaces for carbonizing was set up in the Chemical laboratory and gas connections made with the main pipes.

Gasoline Vapor. The six inch carbon treated in Gasoline Vapor last night and put in a lamp was exhausted and tested to day. At 16 candles 90.4 ohms resist. 88.3 volts. At 8.6 per horse power, Book No. 112 page 99 &c.

July 31st 80

Was around for past week. Messrs Edison and Batchelor making some interesting experiments with carbons and with discarded carbons and means of carbonizing. Andrus making carbon forms of different devices for use in the large 30 carbon moulds of gas furnace. Dean drawing fibre clamps and forms for four six and eight inch loops. Ott drawing on electric locomotive insulated car wheels and roller dampers. Upton has been three or four days drawing specifications. Cunningham making glass plate on the device for holding tubes for heating over gas flame. Described under date May 28th. Several tables filled for glass blowers at Lamp factory. Hammer making the rubber connections between pumps and mercury pipes. Kruesi's gang wrapping and tarring the 20 wire circuit. Carpenters building the large magnetic separator.

Absent Messrs Edison and Batchelor went east on 3 20 train.

Monday Aug. 2.

Fibre tester. Mr. Batchelor devised an instrument for testing or proving fibre. Sketches Book No 105 page 35 &c. It ~~consists~~ consists of a metal base or table darkened, and on which the end fibre may be secured, a folding magnifying glass has a groove of about .012 diameter cut across the pan forming the base when spread ready for use, in the hole in the base are secured a couple metallic pieces with the ends approaching to precisely .012 of an inch of each other. after securing the fibre on the table the glass and frame may be passed along the fibre and any variation in the diameter as indicated by the two metallic points or gauge can be observed through the magnifying glass

Pump motor. The dynamo motor and empty pumps at lamp factory were run some time today to polish up and loosen the bearings &c.

Gasoline carbon. The lamp made with carbon treated in gasoline vapor Friday night was tested again today, after burning at 16 candles for a very few minutes a bad spot appeared in the top and at 7 candles ladder only is shown.

Calorimeter test. Mr. Upton made a calorimeter test of a paper carbon lamp, and then dipped it in tar. and dried it after which another calorimeter test was made the darkened globe made practically no difference in the results. Book 112-13.

Support for dynamo shaft put in yesterday.

Drop tube. One of the new pumps which has been in nearly constant use for about four weeks was observed to be cracked in the fall or drop tube where the drop strikes the solid mercury column, the crack extended for a length of about six inches and appeared to be caused by inside action, and is undoubtedly due to the incessant pounding of the mercury.

6 in Bamboo. Lamp burned 3 hrs 24 min at 71 candles and gave nearly 7 per h.p. the best lamp we yet made. see page vegetable carbon Book 112 page 119 &c.

Papers. Herald of today publishes sketches and comments of Mr Edison & the captive balloon experiments in connection with a long article on aerial navigation.

Engine, the engine fell in new hands to day by Hood the engineer very unceremoniously leaving, "California" taken charge.

Gas furnace, connected with blast and gas pipes in carbonizing room, the blower did not give sufficient air blast so one of the glass blowers tables and bellows were carried in and the furnace heated. One of the large moulds for 30 carbons was put in and on first trial it was found that the gas had gotten in around the jointed base and formed a sort of tar which held the carbon together. Mr Batchelor then drilled a small hole in top of mould and used pipe clay around the base or lid and the second trial with mould thus arranged the carbons came out first class

Mercury. The flasks of mercury were taken to the machine shop to start the stoppers after which they were returned to the Factory and Hammer set at cleaning the mercury preparatory to putting it in the pumps.

Research. Dr Moses has been engaged now nearly a week in searching the scientific books of the office library for all items subjects connected with the electric light and lamp. carbons, vacuum, etc See Books Nos 127 & 128.

P.O. Drawings. The new draughtsman in Mr. [illegible] office has now on his table, sketches by Mr Edison of the following devices from which to make Pat Office drawings. A lamp with wires sealed through two small buttons on a stem of solid, or a tube of, glass the upper or inside button and glass stem being a support for the wires and the bottom button through which the wires are sealed is then sealed with the tube of outer lamp

globe to form the vacuum chamber. Another with wires sealed along the outside of the inner tube or stand stem and admitting of sealing at any point with the outer globe. Another with a small globe at bottom of the large one, through which the wires pass and are there sealed and which is also exhausted simultaneously with the lamp globe, so that in case of leakage at either point of sealing the lamp remains unaffected. Another lamp with a single straight upright carbon held at top by a metallic oval brace to which the upper end is clamped. Another with two straight upright carbons approaching each other at top and there clamped together. Another with two carbon loops set at right angles to each other. Also a worm or spiral carbon with apparatus for carbonizing the same. Also the carbon former with loose center and end weight to which the ends of the carbon are secured with small

pins, And also a sketch of the device for treating carbons in gasoline vapor as described under date July 30.

Visitors Mr. Miller here all day.

Fibre clamps, or formers. One pair for six inch fibres with cast base and under lever for clamping, were finished by Dean and set up on Bradley's bench. Some fibres were taken out of them and carbonized very nicely and are very convenient and effective and work satisfactorily. See July 14.

Wednesday Aug 4. 1880

Making Bamboo. Wm Wright is making an instrument for splitting out the Bamboo. On either end of a steel bar a long side or slot is drilled through the steel and the metal on each side of the slot is then worked down to an edge, very thin and bevelled only on outside. Dean is making some more of the ~~rough~~ trimmers or instruments for shaving the material down to required thickness.

Carbonization The gas furnace has been in use to day, and with six formers in the moulds this day, six carbons were gotten out safely and the furnace gives perfect satisfaction so far. One of the carbons gotten out on first trial was put in a lamp and stood well through the heating on pump and in the test it was then set at 48 candles but was accidentally broken by falling

In tested 178.1 Ohms at 16 candles and 161.6 ohms at 48 candles Book No. 112 pge 200 &c.

Straightening carbons. Some of the longer carbons have at times bent over to one side very much after they had been placed in the lamps and sealed. To straighten them the lamp is placed between the poles of an electric magnet and the current turned on the lamp. One pole attracts while the other repels the charged carbon and the lamp is placed between the poles in such proper relation that the polar action is utilized to straighten the carbon through the glass globe. I find that this "little dodge" has been worked for some time but to day is the first I have caught them at it.

Mercury. The mercury received for the pumps is exceedingly dirty and Hammer is still at work cleaning it.

Notes on Gas furnace, with additional device for the carbon formers. Book No 105 pge 398 &c.

Carbonizing &c. / Notes on Gas Furnace — The Gas furnace has been giving excellent results to day and Andrews is making the standard for the moulds which are intended to hold about thirty, eleven of which are completed and in use. Find in Book No. 105, page 39 &c. notes on carbonizing and particularly on the Gas furnace and Carbon formers, ~~date~~ made during last night and to day, in which he suggests to make the furnace in sections, also to conduct the gas through rubber tubing so the burner may be removed out of the way when not burning. And also some additional sketches and description of weighting and forming shape of carbon.

Papers. — Herald to day describes Stephen Dudley Field's electric engine, application filed June 9. Patent issued July 13. Caveat claimed to have been filed over a year previous. Article states Edison's engine first tried May 14 — which is not so — is a mistake

Mercury Pump. — The power Mercury pump at Lamp Factory was tried to day with mercury. Quite a number of leaks were discovered in the joints of the pipes &c. and at the nipples. And it was very evident that the belt on the cone pulleys would not answer for gear. The belt was slipped every time an effort was made to start the pump with the power from electric motor, which showed a willingness and power to do its work.

Clutch gear. — Discovered to day in Book No. 135 page 65 &c., under date Aug. 3 a sketch by Mr. Edison of a clutch designed to work on the driving wheels of a locomotive instead of on the rails. Also some notes and reminders of matter to be incorporated in patents.

Kerosene light / Cost. — Lamp measured 15 8 candles, after burning, the heat raised it to 11 candles. After burning 7½ hrs it had consumed 11 fluid ozs oil. .190 gal per hour per candle Book No 112 page 213.

Paper. I hear that the [illegible] Herald to day has a reported interview with Edison in relation to the electric engine. Could not find a paper to learn any particulars.

Pat. drawings. Mr. Edison made sketches of cams Pumps of Pump and electric motor connected, also of electric locomotive which was given the New Brand man to make Patent Office drawings.

Rail Road. On second trip to day the motor was found to work badly and upon examination it was found that a cross had formed over the washers between the commutator brush holder and the block holding the two brush holders by metalic dust accumulating upon it. It was remedied and on the next trial not working satisfactorily it was on examination found that the wire of one of the magnets had crossed with the base and ~~then~~ it was found necessary to remove and rewind it. One of the armatures of

the dynamos was also burned out, but the armature has not been unwound and I was unable to discover or learn the point or cause of the cross. The principle burn seems to have been on the commutator Blocks.

Leaning Loops. Mr. Batchelor gave his views of the cause and possible remedy for the loops leaning or bending over on one side after heating in the lamp. Believing it due to unequal heating in carbonizing and a unequal contraction in the lamp by the heat. Book No. 105 pge 55 &c.

Telephone receiver. John Ott put a screw or worm gear in the shaped receiver to get more power and less speed on the chalk.

Friction Ratchet for transmission of power described and sketched by Mr. Honig. Book No. 101 pge 116c.

Visitors. Wilber, Goddard and Ganaw acquaintance of Mr. Edison's.

Absent. Mr. Upton went east on short visit to family.

 Saturday Aug. 7.

Locomotive. The magnets were taken out of the locomotive ~~and wagon~~ to be [illegible] And the one covered with tape was unwound and rewound: And now that the engine is apart and the gear about ready to put on, it will be equipped with the substantial gear before replacement in place.

Visual Indicator. Another of the Sage visual Indicators was brought and set up by McKenzie.

Work general for past week. Team drawing coal dust from the case of which the laying on the switch for Mr. Edison. Men continuing work cleaning out the Pond. Ott remodelling and putting new gear in telephone receiver, Dean making former in which to cut Bamboo fibre. Mr. Batchelor carbonizing and experimenting on apparatus for that purpose and has worked it around "nice". Mr. Wilber was most of the week getting up specifications. Men preparing Lamp factory for occupancy, by putting in the final trimmings,

[illegible] Chas. Mott [illegible]

Monday Aug. 9.

Engine & Boiler. The caps were removed from the boiler tubes and men at work all day yesterday and last night scraping and cleaning the tubes and [illegible] at work making the necessary connections [illegible] the coal dust [illegible], preparatory to using the dust when again fired up. Mr. Batchelor was here and took a look at the arrangement and had one of the tubes taken made examination of the tubes &c.

Carbonization. Mr. Batchelor yesterday made memorandum of the experiments to be tried ~~with~~ different heats &c. to discover the cause and possible remedy for causing the carbon loops bending to one side, (Book No. 105 page 61 &c.) To day all attempts at carbonizing have been discontinued at the Laboratory and Mr. Batchelor and VanCleve are preparing the table and putting up the gas furnaces at the Factory.

Paper. New York Times to day, publishes a fair and favorable two column article on "Edison Light & Electric Rail Road." Go & read.

Engine &c) Power not running to day, and Shop } Dean still at work on boilers &c, and Logan at work at putting the gear on the electric locomotive. Kruesi taking advantage of the lull by having some of the trees and hangings of shafting and lathes cleaned and overhauled and some of the machines shifted and newly arranged for a few days since. Business appears to have gotten the upper hand of Invention, & experiments and important items for record are correspondingly scarce.

Stationary electric engine. Hornig is working on the details of a stationary elec. eng. in which a connecting rod from the eccentric or crank on armature shaft works upon an arm extending from shaft of driving wheel to the periphery thereof and there propels the same by a friction clutch acting on the periphery, and the speed may be governed by the distance between

the ~~the~~ joint of the connecting rod and the arm, and the clutch on periphery of the driving wheel. The design is for any use to which a stationary ~~steam~~ engine is ordinarily assigned.

Absent. Mr. Clarke gone to Philadelphia & Mr. Upton still absent sick.

Teleph. central Station. Six telephones were received from Bergmann this morning to be set up to demonstrate the call or central station system in the use of Ponds visual Indicator, to denote the No. of subscriber wanted and the drop also made by Bergmann to indicate the No. of the caller. The instruments have been placed at different points about the works and work quite satisfactorily.

Dust coal furnace A light fire was started this afternoon in the furnace for burning dust coal and will be kept low all night to thoroughly dry the mason work and be ready to test it thoroughly in the morning on getting up the steam.

Gas House. Clarke here to day and put the Oil &c in the tank of new Gas house at Lamp Factory to have gas in readiness for the Root pressure blower to give it the pressure ~~in the~~ to morrow if the engine is run.

Old Paper Loop. The carbons were taken out of a couple of the old card board lamps that had burnt a long time and carefully measured by Mr. Batchelor. One face 0.063 of a sq inch as surface of one face and 0.021" wide & 3" long. Book 114 pge 1.

 Wednesday Aug 11. 80

Machinery. a new large lathe and very large drill press received and set up in shop

Dust coal furnace. was fired up strong to day and held 65 lbs of steam for about 1½ hours but the arrangement was very uncertain. pumping water in the boiler reducing the steam pressure, to about 40 lbs. and opening the doors in front of boiler produced almost an instantaneous fall in the pressure. In the evening the pressure fell to a very few pounds in spite of their best efforts. (unless it proves more stable and reliable tomorrow, the grates will be replaced under boilers and the experiment discontinued for the present) whether the unreliability is due to the inefficiency of apparatus or inexperience of men. in attending it remains to be determined.

Work orders given by Mr. B. to run and work day & night as long as there is a man here to attend it.

Gas Works. The Root blower at Factory was started and run to day and appears to be efficient enough for the work required of it there, but the gas apparatus seems to be totally insufficient to supply the glass blowers jets now up: independent of the carbonizing furnaces. which are also to be supplied with the gas.

Carbonization. Mr. Batchelor is to day carefully making the experiments on heating the carbons differently and at different degrees in the muffle furnaces. in pursuance of the notes Book 105 page 61&2. to determine if possible the cause of loops breaking &c.

Lamps &c. Memoranda of work to be done and preparations to be made to start if possible. 200 lamps on Friday Book 112 page 257 &c.

Visitors. a Reporter of the Times.

Absent. Mott C.P. in New Brunswick all day on some business at County Clerks office for E. & B.

Paper Herald to day publishes a lengthy acrimonious letter from Sawyer in which he positively contradicts all ability on part of Mr. Edison to make lamps at less than two or three dollars apiece and nor to maintain more than one or two per horse power, and tries to prove his hobby and mistaken idea that electric lamps must have low resistance for economy of current.

Mercury Screw Pump. The cone pulleys were taken down, as N.G. to be replaced with other straight pulleys.

Coal Dust. Sent this morning for a small engine and a Boston blower for giving blast to coal dust furnace, and had them up and started by about 3. P. M. It is found to assist very much but no merit has yet been demonstrated to enlist confidence in the arrangement. One great disadvantage being the uncertainty of steam pressure

Telephone calls. Bergman made the alterations suggested to him here some days ago on his magneto call, and connected telephone therewith and sent one here to day, it was tested by Mr. Upton and found to work very well. No. 114. page 81.

Call box. John Ott is making a working model for an automatic call box for the Cond Indicator as designed to be used in the telephonic central system and the box is designed to call any number desired by the caller or operator.

Carbonization. Mr. Batchelor's experiments with different heats did not solve the problem of reveal the cause of the loops bending over. A thorough discussion to night suggested the theory that it might be due to the fact that the way the present loops are cut and carbonized the pith and outside of the Bamboo always comes on

the side of the loop. and to test the theory whether the pith side, being more loose and porous than the outside did not shrink more from the effects of the heat, than the more firm and compact outside. It was determined to change a Carbon forming mould so that the widened ends might stand ~~parallel with~~ at right angles with the face and thus bring the pith either on inside or outside of the loop. The mould was thus arranged and between twelve o'clock and morning Mr Batchelor got out three or four. had them put in lamps exhausted and heated very high and to the gratification of all the loops remained erect and they justly feel that the problem is solved and that carbonization is now worked to a fine art.
Book

Absent Mr Edison East probably in New York all day
myself in N.B. all day. Wilcox here interested in coal shaft

Carbon Formers. All the blocks used in moulds as formers or shapers for carbons are being changed by Andrews so as to hold the widened ends so the thin edge of them will stand towards the faces in the lamp. by which means the fiber will in every case be bent so that the inner or pith side of the fiber will come on the inside or outside of the loop instead of on the face as formerly.

Meters. Mr. Edison wrote descriptions and made sketches of several new forms of electric meter in Book No. 132, page 1 &c.

Absent Mott at New Brunswick and finished up the work recorded Book 136, pages 1 &c
Mansfield Lands &c.

Saturday Aug 14-

Patents Mr. Wilber took with him to Washington several Patent specifications and left with Mott for copy, The Specifications for Edison Electric Rail Road to be sent to foreign Countries.

Furnaces. Mott sent to Woodbridge to order three Gas furnaces for carbonizing to be made with the square holes, for vent in the top of the lid instead of the side and to have two one inch bands one around the lid and one around the furnaces goods promised to be delivered in 10 or 11 days.

Gas Apparatus. The gas Apparatus at Lamp Factory not giving satisfaction one like now used at Laboratory was ordered in the mean time Patrick Clarke has small boiler there to further experiment on his machine by heating the water.

Work general for past week. Mr. Batchelor experimenting to determine the cause and devise means to prevent the long carbons from bending over side-ways in the lamps, found the cause and remedied the defect by removing the cause. Men under Logan setting the cast gear on the electric locomotive. Trying the experiments with the coal dust ~~experiments~~ furnace and experienced great delay and annoyance by it, N. G. Testing the blower and Gas supply at Lamp Factory, the former efficient but the latter has neither capacity nor simplicity for practical use there. Men wrapping conductors with muslin tarred and then wound with marlin and again tarred, Mr. Wilber here several days at work on Patent Specification

Monday Aug 16.

Meters Yesterday Mr. Edison made sketches of several different forms of meters and means connected to lamp for measuring the electric current which were given to Mott from which to make Patent office drawings for caveat.

Factory Bradley set seven boys at work in the lamp Factory on Bamboo working it through the different stages preparatory ~~to~~ for carbonization.

Coal dust. The engine is still running this morning on coal dust and has improved somewhat through more experience of the tenders. but the improvement does not warrant longer trial and at five oclock the engine was stopped and men set at work removing the masonry from the boiler fire box and replacing the grates preparatory to return to old principles

Absent Kruesi at Philadelphia

Fruit in Vacuum. Mr. Edison had Boehm seal some fruit in a chamber arranged to exhaust on the pump. in a couple attempts the fruit was injured by the heat but one pear was inclosed with slight injury and after exhaustion was hermetically sealed. and taken by Mr. Edison. I judge the experiment to be for purpose of testing or observing the action of the fruit when thus treated.

Bamboo Splitter Dean furnished a machine for splitting out Bamboo in which the knife is secured on a block of iron as a slide or carriage which block is then secured in a carriage frame and is driven down through the bamboo lengthwise by a treadle after which the knife is raised to its first position by a spring or weight and pulley. The bamboo is held in place on a base by two half circle blocks one concave for outside of bamboo and the other convex for the inside of the hollow bamboo. Which blocks are held firmly against the material by a strong spring.

Lamp tests Quite a number of miscellaneous lamps were put at 32 candles up stairs in Labratory, to test their staying qualities. the carbons were taken without regard to perfection and all those having spots went first. some of them lasting from to six hours.
Book No. 123 page 142
Some of the old lamps made six or eight months ago and burned a long time last winter were examined for vacuum by a sparker or Induction coil and the ones sealed with white or annealing glass and those with common glass extended along the wires had retained much better vac. on the average than those plainly sealed through the ~~plan~~ thin glass. One of the long bamboo carbons in a lamp No. 1360 ~~bent over~~ after burning about two hours bent over till the carbon touched and blistered the glass but burned in

that condition about half an hour before the carbon broke.

Gas Apparatus. Mr. Edison had Boehm make an apparatus for making gas and giving equal steady pressure to it which is composed of a bottomless bottle placed in an open jar in which a quantity of mercury is placed, and the bottomless bottle forced and weighted down therein. the gas is generated from Sulphuric acid ~~and~~ placed in a suitable reservoir and set in a hot sand dish. from the generating reservoir the gas is conducted through a glass tube over top of jar down to and under bottom of bottle thence up to and above the surface of the mercury where it is set free in a pressure reservoir formed by the top of bottle as top and sides and the mercury as the bottom and made gas and air tight at top by a rubber stopper flooded with mercury

through which by another glass tube and rubber hose attached it may be conducted where wanted, in the present case to a chamber for holding the clamped carbon loops, which may be filled with the gas and the carbon heated by current either for test or for accumulating hydro carbon thereon sketches Book No. 68 page 191 &c.

Carbonization Van Cleve made the commencement at carbonizing in the Factory to day and from first mould of twelve carbons and formers got out eleven in nice order, and from second mould of fifteen carbons got 13 out successfully.

Bamboo straightening. Mr. Batchelor placed two split pieces of Bamboo, about ⅓ circle on an iron plate mean 20 lbs weight and burned two ~~gas flo~~ bunsen flames under the plate to see whether the circular parts would flatten under the influence of the heat and pressure, but the Bamboo resisted all efforts

Visitors Herald Fox here in evening

Glass. Two boxes of tubing from Corning N.Y. glass works received at Factory and upon test by Holzer pronounced very good glass for the purposes of the lamp.

Bamboo. First bundles of common Bamboo were recd. this morning and cable prepared to send to Japan for a quantity of large Japanese Bamboo.

To further experiment on straightening or flattening Bamboo Mr. Batchelor had some prepared same as yesterday and in addition to the weight and heat had the hot steam, about boiling point or a little above, playing on it for a couple hours but without avail, his belief is that with very hot steam, the bamboo might be softened sufficiently to yield to the pressure and be flattened.

Carbon Several bamboo strips were cut eight by sixteen thousandths, and put in lamps so the thin edges would form the face of the loop; idea to more effectually prevent their bending over.

Reverser. Mr. Edison sketch a modification of the cylinder current reverser reduced in size to make it applicable to each individual lamp in which it is used to put on or cut off current and being always turned one way; the current is reversed through the loop at each lighting. sketches was given to Dedd for caveat drawings.

Absent Messrs Edison and Clarke took 7.35 train to Philadelphia and returned about three thirty.

Visitors Col Lars brought some choice selected fruits to be sealed in vacuum.

Factory. Four young men set at glass blowing at Factory by Holzer, Men commenced boarding up fence around lot there. W. L. Clarke lit all the gas burners and burned them for forty minutes to test the capacity of the Clarks gas apparatus. Van Cleve changing the form of the stands for gas and air for carbonizing furnace, so that the main gas pipe taps the stand pipe between upper and lower burners to give more equal flow or supply to each.

Armature. The armature of the machine used for supplying current to the pumps in Laboratory, mysteriously gave out this morning and no external examination or test would reveal the point or cause.

Vice. Mr. Batchelor devised and sketched a convenient little vice for holding and bending the wires after which they may have the threads cut and clamps secured thereon without removing or rehandling. Sketched in Book 102, pge 73 &c. Now being made by one of the men in Shop

Lamp test. The lamp completed last night, with a carbon full usual length but 0.008 by 0.016 was tested by Francis at 10.66 candles Resistance 210 ohms. and 8.4 per horse power. At 32 candles 188 ohms Resist and 5.6 per horse power. Book No. 104 pge 48.

Lumber. Mott went to Metuchen to see Freeman in relation to fence lumber, that now delivered being very poor and to be returned and better quality delivered in stead.

Fruit in Vacuum For Col. Gouraud, several packages exhausted and successfully sealed up

Armature. Another armature was burned out this morning in the same machine that burned one yesterday.

Clamp Machine. Some of castings for the clamp machine have been received and Logan is turning the base and some of the heavier parts.

Carbon tester. An ~~app~~ enlarged tube shaped for rubber cork and mercury flooding arrangement was connected directly to one of the pumps this morning for testing the carbons, the inner tube is passed through the rubber stopper which is then flooded with mercury, the tube or chamber is then exhausted and the carbon heated red to note imperfections. It was found necessary to have tube and stopcock connected to the chamber in order to let air in gradually after test otherwise the sudden influx of the air would break the carbon. tube and stop cock put on but not tried

Rail Road. Men cutting the grass and weeds from the track and putting the same in readiness for test of the Grand Locomotive

Research Dr. Moses still employed in Library. And for past few days Messrs Upton & Hammer have been in there at work on mapping New York City in Station Districts &c.

Visitors Collins of Herald and a couple foreign tongued mining men with samples of ores.

Locomotive. The New gear of the electric locomotive was run some little time this afternoon, to grind down and wear smooth. Before the test was finished an armature in station burned out, thus stopping the test or trial.

Silica deposit on carbons, with the apparatus described Aug. 17. Dr. Haid has been today treating carbon in gas by heating with current the loops in the chamber through which the gas passed &. did not get the full results of the experiment.

Work general for past week. Men putting the gear in the electric locomotive. Dean making cutting clamps & formers for Carbon strips. Andrews making carbon formers. Ott & McKenzie on call box for End indicator. Upton making calculations of the copper conductors &c necessary for a lighting station in New York. Clarke working on Dynamo Mchns Book No. 116. J W Batche superintending starting the Lamp Factory. Absent Mr. Edison went to Asbury Park in afternoon.

Dynamo Station Several of the men worked all day yesterday and last night putting up the heavy shaft and large pulley for running the dynamo Station. This Morning the large heavy belting was secured. and power shut down in the evening for the man sent here for the purpose, to make the splices

Central station for Light &c. } Mr. Hornig finished diagram of a central station for light and power. fitted up with Porter Allen Dynamo, Engines.

Electric Locomotive, as equipped with gear ~~and~~ and creeper was tried, the creepers did not work entirely satisfactorily but the difficulty was easily detected and can be readily remedied. by strengthening the springs that govern the eccentrics or gripping blocks and possibly attaching the lever back of the center of

shoe to obviate the tendency to lift up. The friction wheel ~~however~~ of slow speed does not hold very well. would not hold sufficiently to carry the motor up the grade beyond the Pond. and heard no suggestions as to how the present wheel with so little required surface could be improved,

Armature, during the test of the Locomotive. Another and the fourth Armature was burned out in the same magnets, so many Armatures giving out in this one Machine would seem to indicate that the magnets in some way might be the cause or partial cause of it, but that theory or suggestion does not seem to be entertained by those most familiar with the machines. One fact is observed in this machine. that I have never known of in others, and have not been able to get an explanation of it and that is that a short may be had by contact

between the base of the magnet and the commutator brush or holder.

Call box. John Ott and McGlinzie have completed and made several trials during the last few days of a call box for the Pond indicator. In the indicator the figures are thrown in position to read, made at the end of the line by telegraphic characters and to simplify the operation so that any person unacquainted with telegraphy may signal. the box is an arrangement of three index slides on each of which the necessary contacts for the characters representing the different numbers are ~~represented~~ formed by raised blocks ~~or parts thereof~~ and after each slide is adjusted to the numeral desired the contact is rapidly made by a spring ~~which is~~ with a platina point which is drawn across the raised characters by a clock work

Visitors Messrs Elder and a friend also Col. Gouraud.

Pump. Bohm. ~~connected a carbon testing chamber,~~ made ~~to~~ a single drop tube pump. without gauge. ~~Also~~ used to day for obtaining vacuum in fruit chamber. it works very well and the experience of the men in running the gauge pumps has enabled them to judge the vacuum very accurately by the appearance of the fall or drop tube.

Carbon tester. Hill using the carbon tester on one of the pumps and is able thereby to note very slight imperfections in the carbons and reject such as are unsuitable for lamps.

Shafts & Pulleys. the shafting for the Power Mercury pump was received at Lamp Factory together with some pulleys which were not the proper size and will cause some delay in being replaced or made to fit.

Fruit in Vacuum. Col. Gouraud having sent more Peaches here to day, the boys have been sealing them in vacuum for export with him.

Visitors Mr Wilber

Short circuit. Late last night, it was discovered that severe work was being exerted on the Dynamos. and by them indicating that the lines were crossed. The engine was stopped and examinations and tests showed the cross to have in some manner occurred in the wires leading from dynamos to the Rail Road Station which were cut between the branch Factory wires and the rails so as not to interfere with the power at Factory. the cause or point of the cross was not ascertained, but, these results impress one with importance the necessity of the utmost care and attention in properly insulating and protecting the wires used as conductors.

Power pump. at Lamp Factory having been reequipped with straight pulleys and counter shaft was run empty some time to day.

Locomotive. the friction gear and shaft were taken out to improve if possible the friction of the slow speed clutch.

Ore washing Machine Force is building the experimental ore washing machine described under date July 20. and sketched in Book No 126 page 5.

Lamp Sockets. Mr. Batchelor devised and sketched several forms or styles of sockets for Lamps which may be found Book No 105 page 97 &c.

Patent copy. received for copy, the specifications for European Patent on the Lamp. its parts, and means and appliances for manufacturing the same. will comprise 30 or 40 pages.

Visitors Puskas. Collins, Wilber

Gas Machine. A large "Combination Gas machine from Detroit Michigan was received at the Lamp Factory this A.M.

Pumps. Several of the pumps at Factory were found to have been broken probably by the contraction of the rubber tube leading from them to the mercury pipe above,

Hill and the pump boys are at work cleaning the mercury preparatory to starting the pumps. with other means of cleaning they are using a long tube say three feet formed with a dark crook or goose neck at the lower end the bend of which is filled with mercury and in the long straight part is placed sulphuric acid or any cleansing acid the mercury is then fed in the long tube by a drop or small stream and passes through the column of acid, which coming in contact with and adding to

the bulk of the mercury in the bent part forces ~~out~~ an equal amount out of the other end of the tube, as will be seen this apparatus causes the divided mercury to pass through say two feet of acid, the greater weight of the mercury in the short goose neck part of tube supporting a much larger quantity of the lighter acid in the long portion of tube.

Nickel clamps. Three **lamps** were completed in which ~~Platinum~~ Nickel was used for clamps instead of platinum and they were found to answer fully as well so far as observations made during to day could determine.

Glass Blowing. Boehm with his table and apparatuses was to day moved down to the factory to be employed on second floor thereof.

Building. Mr. Edison made sketch plan of a building 25 x 36 to be erected supplemental to the lamp factory. for storage, packing, office. Photometric Room &c.

Papers. Herald to day contains a letter from Paget Higgs of Boston. replying to parts of Sawin's letter published in Same Paper Aug. 12. the whole being devoted to electric motors- of which he says he has transmitted 98 horse power three miles over a ¼ in wire and shows by results of personal experiments and authentic published statements that Mr. Sawin is off- on electric motors

Clamping carbons, Mr. Batchelor devised and sketched a device or instrument for clamping carbons which was given to Andrews to make sketch Book No. 105-page 107. A table or bed is provided with a middle or inside part fitted to slide in groove and is made to travel therein by a small shaft revolved by the fingers, on which is a small cog wheel with cogs fitting into a cogged or spurred strip secured on the bottom of the sliding table or carriage

On the mobile portion of table the carbon may be placed simply on the flat surface thereof or guides may be used thereon in which to more securely hold the carbon, Near the table is a smaller adjustable rest on which by spring ~~clamps~~ or ways the clamps may rest and be held, and ~~after~~ when the table is moved back by the ~~app~~ apparatus mentioned ends of the the carbon thereon will be inserted in the clamps and be secured by driving the screws with a suitable screw driver.

Insulators. Frances is making some experiments for insulation of wires underground. the materials being tried mixtures of tar paraphine, and similar substances and gums in various mixtures and combinations,

Electro Motive force, Messrs Edison and Upton discussing ways, means and apparatus for determining the electro motive force or pressure in the several lines leading

from any central station and for maintaining and equalizing the same. Mr. Edison made several sketches of devices and means to determine and regulate, which were marked "caveat" but I could or did not get them to determine their nature of their operation or give description.

Absent. Mr. Upton returned from visit to his family, to whom he was telegraphically summoned on Monday last.

Segredo left for Florida and other points South to collect all fiberous woods, grasses, canes &c. that might be used or tried for lamp carbons.

Laboratory. Boys planing tables ~~and~~ up stairs in Laboratory and giving that part a thorough overhauling and cleaning

Patent copy finished second copys of one 27 page European application on the carbon and manner and means of manufacturing same and also a shorter specification for Milling - magnetic separator.

Conductors. Flow and boys discontinued winding with muslin and marking the conductors to street lamps having finished only a portion of the circuits (part of the 25 arc circuit and the Edison line) this work was commenced on the 17 July and has engaged an average of about eight hands.

~~Absent Mr. Upton left for visit to wife~~

Work general of past work. Mr. Batchelor on the drawings and details of clamp machine Dean with several assistants at work on same and on Bamboo cutters & splitters. Upton and Hammer on size length &c. of conductors for lighting station in New York. Clarke still on new form of armature adapted for large machines Smith working to improve the clutch of friction wheel of electric Locomotive

Building. Men digging foundation for a building north of Lamp Factory. for testing proving storage &c. of lamps.

Ground. The hole dug for the combination Gas Machine is being filled up. with soil, iron wire, turnings, tin cans, scraps &c. with large rod running up through to form a ground connection for testing the power to or advisability of running the motors at Factory without a return wire.

Call Box. Mr. McKenzie and John Ott have finished a more complete call box for the Pond indicator which is working very satisfactory

Dynamo Station. The ~~large belts have been~~ put on and part of the dynamos in station belted and running. the wires to Factory having been connected to one so the power there is brought from one of the machines in station

Insulation. A couple of the boys have been winding wires up stairs in laboratory with rubber cloth and taping the same for experiments on insulation. one bare wire tested in barrel of water gave 100 ohms and after wrapping with rubber cloth gave 120 ohms, or 20 ohms difference. Not so good an insulation as was to be expected.

Visitors. Johnson, Bergmann, Pond, Barton of Western Electric. Puskas and Bailey

Absent. Mott absent at home from Friday afternoon till this morning.

 Wednesday Sept 1

Dynamos. New belting and starting dynamo in Dynamo room, partition taken out of shop and pole put up back of station for supporting the wire for Laboratory.

Paper New York Times today publishes a letter from Hiram M. Maxim pointing out and proving the fallacy of the deductions of W. E. Sawyer, as published in his letter and not uncomplimentary to Mr. Edison

Bamboo formers. One of the heavy, hardened steel formers or clamps for bamboo was completed by Dean and sent to the Factory made very heavy to avoid all danger of springing and tempered to prevent scarification by knife or hammer.

Patents drew copies of Specification for English patent No 14. subject of feeding to equalize and maintain electro motive force or pressure Also for Magnetic separator

Absent Upton left for eastern home at 6^20^.

Thursday Sept. 2. 80

Fibre A consignment of about 20 kinds of fibrous products, from Havana was received from Seguin some of the bamboo inferior in appearance was taken to factory for trial

Magnets. The magnet in which four or five consecutive successive armatures were burned out, was today unwound and prepared for rewinding. The suggestion at the time, that there might or must be some defect in the magnet that was the cause of destroying so many armatures, made by a noncollegiate was promptly set down on, as presumptions. But now after a couple weeks have passed the magnet is discovered to have a cross with its base and that rewinding is necessary. Aug 23.

Lamp Holder. John Ott completed one of the lamp holders devised by Mr. Batchelor and sketched in Book No. 105 pge 99. The thumb

screw or circuit completer in this case, admits of turning one way only and the contact is made by the pin connected to the thumb piece, which by a spring is thrown in against a metallic ring fitted to inside of socket. a tooth on the thumbpiece drops into a notch in the sleeve of the shaft or pin ~~making~~ thus letting the pin come suddenly in contact with the ring to complete the circuit and the tooth and notch are so formed that on ~~turning~~ the thumb piece can be turned one way only and in so doing the circuit is suddenly and completely broken.

Ground. Another permanent and thorough ground was put in near the Laboratory for experiments in working a ground circuit for lights and motors.

Mercury pumps. The mercury pumps at Factory were started this after noon on the lecture only and every thing found tight and vacuum formed on some of them very quickly but before any were heated the motor suddenly stopped and upon examination the arms or poles of the magnets were both found to be crossed with the base, necessitating replacement with another machine.

Lamp socket. John Ott finished a some-what different Lamp socket to day in the former one the inside cup or socket was secured in the outer one by a screw on the bottom, in the one to day the inner socket has projecting pin on ~~lower~~ end of inner ~~cup~~ which binds under an single screw thread or incline thus making the contact for one line and holding the inner cup in position

Conductors. A large pole was set up between the shop and laboratory as a support for the laboratory wires and brackets put on the poles leading to the Factory for light wires to be run to there. And Mills running the wire and connecting the machines in the dynamo Station.

Insulation. Francis tested about 100 feet of Kerite wire in water, and found it one million ohms, about same length of heavy braided insulated wire gave about 3600 ohms resist.

Fiber Moulds. The moulds made by Dean which have been in use several days at the Factory having become partially clogged with dirt mostly from rubbing the fingers over them, were brought up to be cleaned.

Visitors. The Electrician of American District Tel. Co. with friend in chg of McKenzie

Papers. Herald to day contains another communication from Paget Higgs, replying to Sawyer on electric motors.

Motor Dynamo taken from Station to the Factory for use in running the pumps. after wires were connected and before the plug was put in the current crossed in some way (through the wood of switch of plug board probably through the oily portions, some part of it having been accidentally saturated with oil.)

Lamp Stand. Duncan is making a great number of common plain lamp stand holders for testing etc. a saw cut is made down through opposite sides of the socket through which the wires may extend and be secured under springs which are connected to the circuit. the lamps may be very quickly placed or removed without any previous preparation. after which they may be placed in the commercial socket.

Cable insulation. The experiments on the insulation for cable conductors are being continued with Muslin, rubber cloth, tars gums &c. the full particulars of the insulating material and forms of insulation are in Book No. 104 page 73 &c.

Absent. Mott returned to night after an absence of two weeks on vacation.

Mr. Upton still absent with his family.

Work general. Mr. Batchelor on detailed drawings of Clamp Machine and Dean and assistants at work on same and on clamp former for Bamboo. Smith remodelling the friction clutch wheel for electric locomotive. Men digging foundations &c. for building and gas works at Lamp Factory and pumps there prepared for starting.

Motors. The dynamo taken to the Factory on Saturday was returned to day having found to be crossed both poles of Magnet and also Armature commutator with base. The armature of the one brought up on Saturday was also found to be crossed with the shaft.

Gas Furnace. Three additional Gas Furnaces for carbonizing were delivered at Factory this morning. Now making in all five (all that provisions have been made for) these ready for use. Men also at work there putting in the Consolidated Gas Furnaces.

Vice. W. S. Andrews is making in pursuance of sketch by Mr. Batchelor, a vice for holding and bending and holding the lamp wire for tapping and having clamps put on, the present vice is somewhat different in construction from the one now in use, but not sufficiently advanced to admit of a description.

Call box. during yesterday by request and instructions from McKenzie John Ott made drawing of a call box in which a wheel takes the place of the slide used in the present box. he is today making the ~~Mott~~ patterns for castings for it. Tracing of the drawing was made by Mott and the original taken by McKenzie.

Fibres - ~~Bamboo~~ Another consignment of fibres ~~was received~~ to day from ~~Segredor~~ from Florida.

Visitors Prof. Rowland, Col. Eaton. Johnson.

E.L. Fixtures. Mr. Edison made sketches of a number of styles and ways of running and concealing wires on Gas Chandeliers some devices being fitted to permit of the use of either. Electric or Gas Light without interference with each other.

Conductors. Wires for lights and carbon testing were run to and into Factory. to have current independent of the power circuit.

Factory addition. Masons commenced laying foundation for the store and packing house supplemental to Lamp Factory. Cateman House about finished and occupied by him.

Clamping Carbons. the ~~moving~~ movable table machine for holding the clamps and introducing the carbon for clamping made by Andrews and described under date Aug 27. was set up and tried today at Factory by Charlie Hammer, he finds it very convenient and handy.

Dynamos. Forgings of soft iron for the magnet arms or poles and top piece for the large 100 horse-power dynamo were recd. Another of the regular dynamos being the third machine, was taken to Factory to replace the one crossed. and to be used as pump motor.

 Sept. 7. –

Lamp. Hipple to day called my attention to a lamp he had made using a new style of enlargement on the inner tube and which after sealing together had remained over a day without cracking or checking and which had not been annealed. After heating the inner tube as if for blowing the small bulb or enlargement, he simply pushes the ends toward each other and the heated part is thus made to project all around forming a thick disc on the tube, the globe part is then prepared for the inner tube by slightly thickening up at the point of sealing so that equally thick and ~~equally~~ heavy glass are sealed together and the liability to crack lessened, over cases in which the thin glass is ~~annealed~~ sealed with thicker glass, as in the former way of blowing a small globe on the inner tube thus thinning the glass of inner tube which would be sealed to the thicker glass of the outer globe

Wednesday Sept. 8.

Insulation

Cable No. 1. Rubber cloth, white, each spiral overlaping about 1/3 width, tarred well with coal tar boiled stiff - put on hot = 54 ohms

No. 0. bare wire, No 10 - 100 ft long = 127.

No. 2. Three thicknesses white rubber cloth each tarred with boiled coal tar, 51000 ohms fell to 4850 - 3200 - 2680 - 1500 -

No. 3. Two thickness white rubber cloth wound in opposite directions. 77 ohms.

No. 4. Three Muslin each covered with boiled coal tar, 120 ohms.

No. 5. 2 - Muslin each served with hot Linseed oil, 470 ohms 140 ohms 110 ohms,

No 6. Muslin ~~served~~ wound on cable 1 thickness served with paraphine then black rubber cloth. then Muslin again & paraphine 1200 ohms. 171 - 120. ✓

No 7. Three Muslin each served with coal tar treated with quick lime to neutralize acid 720 ohms. ✓

No. 8. bare wire rubbed with cold paraphine 1 layer black rubber cloth, black rubber cement, then rubber cloth, smoothed down

with black hard paraphine 12500 ohms
7000 - 130 ohms.

No. 9. Same as No. 8. except rubber cement was replaced with hot paraffine. 9000 ohms 3500 - 120 - ohms

No. 10. bare wire served with white rubber cement, then white rubber cloth; then compound, No. 3. rubber cloth then rubber cement, then again rubber cloth and rubber cement, dusted with percipilated chalk. 299,000 ohms. 1400.

No. 11. Same as ten except compound no 1 is used instead of compound No 3. 79,000 ohms

No. 12. bare wire wound with Marlin served with compound No. 2. then Muslin soaked in Linseed oil. then compd No. 2. thinned with cotton seed oil, then muslin, then black rubber cloth, then white rubber cement then white rubber cloth 26,000 ohms 1000

No. 13. bare wire wound with Marlin, coiled & boiled in compound No. 3. then covered with rubber cloth. Not yet tested

Compound No. 1. is Asphaltum Pine tar cotton seed oil. No. 2. is rosin pine tar cotton seed oil, No. 3. black pitch, pine tar & cotton seed oil.

The above cables and compounds have been made and tried up to the evening of Sept 8. by Howe

The number and manner of insulating and also the tests of resistance or insulation were furnished by ~~Howe~~ him from a private memorandum book. ~~and~~ the tests by Francis may be found in Book No 137 page 103.

The tests of No. 1. and No. 0. show curious results and speaks badly for insulation or testing. It is rather difficult to reconcile the records with a bare wire testing better than one with an insulation.

Contract. made by Copied by request of Mr. Miller, of agreement T.A. Edison with Biedermann et al. of Switzerland, giving them exclusive use of Patents relating to Light and Power System for that Country for one half of the net profits, and guarantee from any liability or loss.

 Sept. 8.

Pump Motor. The machine taken to Factory yesterday was set running on the pump but after a time suddenly stopped, and on the full current indicated a cross of the armature but no burning or unusual heating. the armature however tested all right with a battery current and the action was rather puzzling. They were led to examine into the cause of the up-stairs machine always giving out and it was discovered that they were using or trying to use a .14 ohm Armature there against a .53 ohm. one down stairs and reasonably supposed that that had caused the dificulty-

Reverser. Mott made Pat. Office drawings of a Lamp arranged with a reverser of his own design, which can be turned only one way and each time that the lamp is turned on the current is reversed through the carbon, or sent contrary to the way it had just previously been passing through.

Thursday Sept. 9. 1880

Papers. To days "Sun" publishes an article descriptive of the progress made by Mr Edison toward the general introduction of his Light and power system and steps made for manufacturing the Lamp and of the perfection to which he has worked the system. but injudiciously fixes date of Oct. 1. for the practical demonstration to be made here.

Station conductors. Messrs Edison and Upton discussing the means and sketching the different methods and ways of running feeding conductors from Stations to the supply lines, to determine the most economical way of maintaining an equal pressure or electro motive force at all the Lamps of the system. Sketches dated by self. Sept. 9. 1880.

Pump Motor. Another machine with a .53 ohms armature was set up at Factory and run ~~for~~ a part of the afternoon supplying the testers and one third (about forty) vacuum pumps, and being of the same resistance of the blower motor no perceptible fau

in speed or power was observed in the blower machine, when the other was put in the circuit.

Cutting Moulds. Dean finished up another fiber cutting mould with an improvement by the addition of a knife on each end worked by a small lever and used to cut off the ends instead of using a fine hand saw for that purpose as has heretofore been done. The work may be done much quicker with this arrangement and do away with the saw dust which was likely to get in the clamp and prevent their proper working.

Absent & Retd. Mr. Upton returned to day having been with his family since Aug. 28. Several of the men are absent to day at New Brunswick on subpoena before the Grand Jury in case of Cornish.

Factory. Heavy beam secured on the roof to which to attach hoisting apparatus for handling the motor.

Pump Motor. The pump motor at Factory is working very satisfactorily to day and twenty seven good carbons were obtained out of thirty eight tested. No lamps yet put on. the chain of power pump caught several times stopping it suddenly and will have to be taken apart and remedied if possible.

Fixtures. Johnson procured a six light chandelier, on which to experiment in artistically fitting with connections, wires &c. for substituting the electric lamp and to arrange for use of both or either without as little change or disfiguring as possible.

Patents. Made copy for English Patent Specifications No. 15. on subject of Dynamos as generators and motors for translating power into electricity and retranslating into power

Visitor. Rebatto of [illegible]

 Saturday Sept. 11. 80

Papers. "Truth" to day publishes the report of their reporter who was here yesterday and gives Mr. Edison the credit of employing two men and accomplishing nothing.

Factory. Power pump taken apart and brought to the Shop to alter so as to prevent the chain from catching. The new Gas Machine was floated from its place in the pit in consequence of water running in during the rain of the last couple days, will have to be taken out and the pit pumped and again dug out. Van Cleve to day put up sheet iron hoods over each carbonizing furnace to conduct off the heat and gas.

Large Dynamo. Mr. Clarke finished the details and drawings for the Large armature, and the heavy castings for bases of magnets were received

Sept. 11.

P.O. Drawing. Mott finished the Patent Office drawing for Dynamo, devised and described by Rowland in 1869. in which the polar extensions approach the armature from opposite sides and the wire only of the armature made to revolve, the iron core remaining stationary or nearly so.

Mail, General of past week. Mr. Batchelor making efforts to get the Factory started, Messrs Edison, Upton and Hammer at work on conductors for central station and plans for laying them. John Ott making McKenzie call boxes for Pond indicator. Dean working several men on Fibre cutting moulds and on clamp machine. Carpenters fitting old glass house for Draughting room, other carpenters at work on preliminary work of Supplemental Factory building. Johnson, commenced on Chandeliers.

Monday Sept 13. 80

Large planer. A large Providence Planer delivered at Machine Shop to day.

Power Mercury Pump. Yesterday Cunningham and Smith prepared the mercury pump to obviate the catching of the chain and it was put together today and has been running very satisfactorily.

Ore Milling. The rake machine for washing auriferous ores &c. was finished by Mar Force and tried to day. but did not work up to expectations. Mr. Edison sketched another device to be tried in page 7 Book No. 126. on a swing or rocker principle.

Absent Mr. Clarke in Phila. to see Porter, Allen, Engine progress.

English Patents. Mr. Wilber getting up and keeping me at work on copies of European patents on Light etc.

Tuesday Sept. 14

Patents. Made copy of Specifications for English Patent on Feeding conductor system; 12 pages and commenced copy of English Complete No. 1. on Lamps, Carbons and Means & Methods for manufacturing the same, compiled from American cases Nos. 215, 229, 233, 210, 227, 220, 228, 216 239, 219, 230 & 240.

Factory. Gas Machine taken out to pump and clean out the pit for resetting. Power Pump run till nearly noon and then again commenced catching and suddenly stopping, believe it will be necessary to again take it apart. The testers with larger contractions were found to break by the weight & fall of the mercury, and a medium will have to be determined at which the pumps will stand and do the most effective work.

 Sept. 14. 80

Lamp socket. Johnson sketched a new socket which is designated as "Boss socket" in Book No. 153 pge 18 which is now being made by one of the new men in Shop.

Visitors. Maj Eaton here part of fore-noon.

Elec Dynamometer. Castings were received today said to be for Electric Dynamometer.

Wednesday Sept 15. 80

Lamps. At factory twenty-five lamps were put on the pumps, and Nos. 3. 13. 17. 18. 25. gotten off the others were about ready to be sealed off when the power pump caught and stopped. and the vacuum was lost. The pump was again taken apart in the afternoon. and taken to the shop to have alterations made to prevent if possible the catching.

Large Dynamo. Zinc castings for the large Dynamo were rec'd today and Logan turning and preparing the magnet-cores for the wire and base and top pieces.

Absent Mr. Kruesi went to New Brunswick this A.M.

Visitors Manager of British Pat Office Museum with his wife here during afternoon and evening. Col Stewart Woolley

Factory. Power mercury pump, had some alterations made on it this morning and put together and set running this afternoon very successfully

Planer. The large planer was geared up and run tonight. A new chain and pulley lifting gear has was used for use at the planer.

Large Armature. Smith today cut out of wood the faccimile of the copper strips that are intended to be used on the large armature.

Patents finished copy of English Patent No. 12. which includes American Nos 210, 215. 216, 219, 220, 227, 228, 229, 230, 233, 239. 240. 241. covering 58 pages and making 64 claims on Lamp & carbons and means and methods of manufacturing the same, which was given to Hughes to carry to Sewell,

Roller bearing. Gentleman here this morning with models of patent roller bearings, did not learn his name or any particular merits in the device.

Planer. The top pieces for the magnets of new Large Dynamo. were put on the new planer and started to dress them down, the machine ran with too much noise and it was stopped and the driving pulleys taken off to try to remedy the objection.

Sept 17. 80

Factory. Power pump worked well till near night when it again caught and stopped. confirming the belief that it is unreliable. and Mr. Batch— now proposes it be taken out and a screw pipe or worm be substituted

Call box. Ott finished a couple of the call boxes for Ponds Indicator, or telephone exchange, in which cylinders are used instead of the flat slides as in the previous ones, are tried to night they worked a rounder very accurately and well.

Insulation. Howell finished cable last night which was put in a barrel of water (soft.) and this morning the bridge indicated no leakage by its inability to measure it, indicating it to have over one million ohms, See Saturday Sept 18. for the composition and manner of applying.

Saturday Sept 18. 1880

Work general past week. Experiments continued in insulating compounds. Mr. Batchelor working at Power Mercury Pump at Factory, but unsuccessful in getting it to work reliably. Mr. Upton at work on Station conductors. Smith on wooden facsimile of Large Armature commutator connections. Logan on casting of Large Dynamo. Dean and assistants on Clamp Machine and fibre formers

Insulation. See Sept. 8. No. 14. 7 strands No. 10 wire bound together with Muslin.

No. 15. 3 Layers Muslin and refuse comp'd

No 16. 3 course white rubber cloth and boiled pine tar.

No 17. Muslin, compound No. 4. two layers then Muslin and oxidized Linseed oil.

 Sept 18.

No. 18. 3 thicknesses muslin & Pine tar.

No. 19. 3 layers Rubber cloth with two coatings of Compound No. 7 none on muslin.

No 20. Same with muslin instead of Rubber cloth, and two coatings of compound No. 7.

Compounds tried No. 1. Asphaltum Pine tar & cotton seed oil.

No. 2. Rosin Pine tar, & cotton seed oil,

No. 3. Black Pitch Pine tar & cotton seed oil

No 4 Pine tar, Venice Turpentine & Rubber Cement

No. 5. Oxidized Linseed oil, Asphaltum, Rubber Cement

No. 6. Oxid. Linseed oil, Camphor & Sulphur

No. 7. Oxd. Linseed oil. Pine tar, Asphaltum and Paraffine.

These data are taken from small book of Howells.

The compd No. 7 was that used on the cable tested yesterday and has been adopted as the best for the purpose of the cables here

Wednesday Sept 22d 80

Absent. Mott absent since Saturday morning. Retd this morning. Last night. Learn that Mr. Kruesi was in Philada yesterday to see about and order a screw pump for factory and Mr. Clarke in New York to see high speed engine on exhibition at the American Institute Fair.

Tar Boiler. received during my absence a portable furnace (or stove) and boiler or kettle for boiling and preparing the insulating composition for the lamp lines. also received

Fixtures. A lot of chandeliers and globes of all styles and colors, to experiment on interior lines and decorations, and different styles of fitting them with the Electric Lamp.

Vacuum Pumps. The long rubber leading from the pumps to the drain or bottom iron pipes of power pump were taken off today and in place of the nipples in the pipe, were put long pieces of tube extending nearly to vacuum tube, and mercury led into them by shorter rubber tube,

Gas Data. Russell brought in one book, the results of his canvass of four blocks for data on Gas, cost, power etc. and matters important to know for the before establishing a Station in the City.

Pat Office drawings. Mott finished Pat Office drawings of a ballance meter arranged to change course of current when the loss from one plate and accumulation on the other is sufficient to

turn the balance or scale, and which also at same time records each vibration of the scale.

Conductors. Men today commenced preparing in larger quantities the insulation used on cable as mentioned on Friday and more fully described under date of Saturday, for insulating the light lines of Street lamps etc.

Addition. Men commenced small addition for shelter and protection to head of the large Lathe when in use.

Visitors. Col. Armitage Gas Engineer who would not be convinced that the size of a piston rod destined for a certain amount of work per minute or second, did not depend on the speed. Nor that a a rod which acted 10 times a second to accomplish a certain work in a second could be smaller than one which did the entire work in one stroke in a second.

 Thursday Sept 23rd 1880

Conductors. Men commenced uncovering again (third time) the conductor trenches of Street Lamps. others preparing Muslin with compound of Oxidized Linseed oil, Pine tar, Asphaltum and Paraffine (No. 7.) with which to rewind the cables.

Insulation Henrig is continuing experiments on an insulation for in doors are trying for a substitute for Kerite.

Absent. Messrs Edison, Upton and Francis went to New York at 3.30 I hear to visit some Gas works. Mr Batchelor also absent part of the day.

Visitors. Mr Whitney of the Firm that cut gear for elec. locomotive. Also Board of Indicator.

Arm tool holder. Mr Kruesi sketched an arm tool holder for Large planer

Friday Sept 24. 80.

Conductors. Fifteen men and boys were to day set at work on insulating the Street Lamp conductors, by winding with two thicknesses of Muslin served with composition of Paraffine, tar Linseed oil and Asphaltum. And Martin Force changing Laboratory wire to the loft and on out side.

Screw pump. Bergmann was here and took with him the drawings of Screw pump from which to make the patterns.

Absent. Messrs Edison, Upton and Francis returned from New York late in afternoon. in their measurements of Gas jets They found the ordinary burner, at usual burning, to give about 7 to 7½ candles but from one burner in Bergmann's got 27 candle power. Notes measurements in Book No. 160 page 5 etc.

 Saturday Sept. 25. 80

Lamps. Geo. Hill put ten lamps on the pumps at the Factory this morning and got good vacuum, commenced sealing off and after getting off three the pump stopped "short" and vacuum in the others was lost. On examination the chain of the pump was found to be broken.

Glass. Four boxes of glass tubing was rec'd at Factory this morning.

Elec. Pen Press. Received at Labratory a Press for reproducing the work of the electric Pen. The Patentee here in the after-noon and received an order from Mr. Edison for one of the presses.

Absent. Mr. Kruesi went to Philada. with pattern for the screw mercury pump and ordered some of Morris & Tasker. Also saw Porter Allen engine. thinks it will be finished in about four weeks.

Visitors. One of the examiners from the Patent Office. Friend of Mr. Wilber.

Work general past week. Carpenters at work on building supplemental to Lamp Factory. Gang commenced third laying of Street Lamp conductors insulating with composition. Large planer running on castings etc of Large Dynamo. John Ott. finished three call boxes for Load indicator. and continued work on wooden face circle of commutator for Large Armature Dean on Clamp machine and Bamboo clamps formers.

Large Planer, during yesterday masons put brick foundation supports under the Large Planer, and removed the iron legs.

Manufactured Lamps. Up to present date twenty seven one half good lamps is the proportion out of 100 fibres. Are now getting out fibres at rate of 550 imperfect fibres per day.

Pump. repaired and again running very successfully all day, and eighteen lamps sealed off.

Carbon Formers. Forty three carbon formers on nickel moulds were sent to Factory to day, making enough on hand there to fill and keep three flasks running. Mr Van Cleve says he can now get out about 100 carbons per day.

Absent E. P. Mott went to house about five oclock and to bed, sick with chills or malaria

Pumps. The pumps at Factory were started this morning with twenty two lamps on. worked well all day and good success had in getting off lamps. 30 of which were sent up here for testing.

Contraction. Mr. Batchelor making measurements and observations on the pumps in relation to the contraction, to determine the proper size of tubing and proportions between contraction and tube, that will give the best results in obtaining vacuum and the least liability to break by the fall or beat of the mercury. Book 106 pge 31c.

Carbon Clamper. Andrews is making an instrument for holding and clamping carbons, similar to one described Aug 27. except that the table in the present machine is so arranged by an incline of the cogged strip that it is lowered from the carbon at same time it is removed back from the clamps.

Office. Corniste at work in the down stairs office removing a portion of the partition and placing it lengthw of the room to give more room in the office part at a sacrifice of the unused room in the front of office

Flat Sealing. Holzer to day showed a new idea in sealing the wires through the inner tube of lamps. and was directed by Mr. Edison to make 100 lamps after the new style. after the wires are put through and secured in the inner bulb in the usual manner, the bulb is well heated all over and compressed again the wires making a long seal. the glass being remaining solid the length of the small bulb say 3/8 of an inch. by compression.

Heat Exp with copper strips } Some cloth covered copper pieces about 1/2 inches in diameter were secured in the core of the armature of

the large dynamo in dynamo station and was propelled by one of the regular machines connected up and run as a motor. Up to 240 Revolutions and running one half hour in strong field. No heat was generated. the third test at 300 Rev. thirty minutes was 7° heat, and at fourth test 300 Revolutions and running one hour the air temperature was 76° and temperature of the copper strip 88°. Book No. 176. page 85

Visitor, Bergman with a telephone also a Londoner, friend of Johnson and Attache of Edison telephone Co.

Elec Pen Press. The press sent here on Saturday and shown off by the patentee, were reshipped to him today.

Papers. The New York "Sun" of to day states that a New Brush Electric Light Company has been organized arranging for in New York City with office at 860 Broadway, with intention of establishing a Station in Neighborhood of Union Square, and a claim to maintain forty lamps with current from one machine.

Call boxes. McKenzie completed and put up two call boxes connected with telephones and working through the drops, both worked admirably.

Organ. The maker of the Laboratory organ is here to day and giving the instrument a thorough overhauling and putting it in good repair.

Factory Lamps. Francis to day commenced testing the factory lamps, at 48 to 50 candles 18 of which were tested to day but not yet figured out. Book 119 pages 5 to 39.

Heat of copper rods. further experiments were made to day on heat of copper rods secured on end of armature and revolved in a strong magnetic field. ~~Second~~ Book 116 page 89

Engine. The Engine was stopped to night in consequence of scarcity of water and will probably not run evenings until after a rain storm or a better supply of water is in some way obtained.

 Thursday Sept 30. 1880

Combination Car was all in position connected up and ready for the oil, the black apparatus was trouble some to day and Holzer took it apart And made some alterations so that later it was working some better.

Decorations. Boys putting different colored double well insulated wire through small thin lead pipes or tubing for use on the chandeliers and any points where protection or concealment of the wire is desirable.

Arm tool holder, an arm extending about fifteen inches out from the usual position of the tool holder on the big ~~planer~~ was fitted up and prepared for securing to the head block for use on the large planer as a tool holder.

Visitors Col. Eaton.

Friday Oct 1. 80.

Tubing Some tubing received for experimenting on the proper size and proportion between the contraction and the tube, to give the best results in exhausting also to determine the more economical size or thickness of tubing that will best resist, without breaking, the fall or pound of the mercury.

Visitors Maj Eaton, and a party of friends were shown through the factory by Mr. Edison

A reporter of World also here in afternoon.

Absent Mr. Upton went east in the afternoon.

Angle plate Andrus is making a pattern for an Angle plate for the Large planer.

Carbon formers New foreign man, next to Andrews to day commenced work on sixty additional carbon formers or moulds same as those now in use.

Carbon Clamper. Andrews commenced work on another carbon clamper, or vise for holding the clamps while the carbons are inserted.

Saturday Oct 2 80

Papers. "World" to day publishes an article, attributing the delay in ~~not~~ making a demonstration here to the fact that the Porter Allen Engine does not come to time.

Absent Edison Batchelor and Johnson went to New York at 6 30. Mott went home sick with the chills.

Work General for past week, Logan. Some of shop men working on Large Dynamo, Dean and assistants on Bamboo lamps and on lamp machine. Painters finishing up new drawing office. Factory turning out quite a number of lamps and Francis testing them. Upton and Hammer on Station conductors. Mr. Batchelor at Factory. Johnson at work on chandeliers.

Wednesday Oct 6 80

Absent C. P. Mott returned this morning after absence at home since Saturday. Mr. Upton also retd to day from visit home.

Chandeliers On Sunday Johnson put up the blocks and tube cased wires for the chandeliers up stairs in the Laboratory.

Visitors On Monday afternoon Pullman of the Parlor Car Co. was here to see about an electric motor for operating a transverse table for cars for which he has a patent but has operated it by man power.

Gasolene Vapor, Mr. Edison is to day making some further experiments with carbons in vapor of coal oil, the inside of the chamber was filled with floting carbon and the loop augmented some, ~~some further operations will be~~ The carbons will be subjected to some further operations to complete the experiment

Combination Gas. Oil was placed in the combination Gas Machine this morning and it is to day supplying ~~the gas for the factory~~ plenty good gas for all the demands of the factory.

Pumps. Men worked all night and till ten oclock this morning on the Power pump and got it again ready for use, but it has not been running during the day.

Meter. Andrews finished a carefully made balance meter which was taken into the Laboratory for to use in connection with his meter experiments & work.

Illumination. About one hundred lamps were lit up stairs in the Laboratory to night and kept part of the time at forty or fifty candles. They were run

all night and at four oclock in the morning about two dozen were left and unbroken.

Engine. Engineer "California" quit to day to seek his fortune in a Patent and Alfred Swanson was given his place at running the engine.

Visitors. Man here offering lands for Lamp Factory.

Segridor returned from Florida on Tuesday

 Thursday Oct. 7.

Tap box Andrus finished pattern for castings of Tap box or box to be used at all points where the main conductors will be tapped with other wires for house or other purposes.

Chandelier. The little frenchman is making a chandelier bracket after sketch and design by Johnson. Book No. 153 pge 44 &c.

Conductors. The line leading from Edison line past his barn and to Street near the gulley was wound and covered in the soil without boxing. and tests 3300 ohms.

Insulating Machine Mr. Hornig is devising and making drawings of a machine for filling piping with insulating material after the conductors have been placed therein in position.

Absent. Mr. Johnson [illegible]

Friday Oct. 8. 1880.

Patent. Made another copy of English Patent No. 14. Subject of feeding with extra separate conductors to equalize and maintain uniform pressure on Lamp or translating circuits. 11 pages.

Interference Edison or Blake. subject telephones evidence being taken here to day.

Indus. Meter Bergmann here and brought the clock work and mechanical part of the balance meter. The box has three dials connected with the clock work which is worked or moved by the action of the current when the copper has been transferred from one plate to the other sufficient to cause the balance to move sufficiently to make an electrical connection by the pointer, which in turn moves the clockwork and dials pointer and at same time changes the direction of the current through the meter cup and receives the copper until the balance again acts and so on during the useful lifetime of the solution and copper.

 Oct. 8:

Chandeliers. Matt Force assisting Johnson up stairs in the Laboratory in putting up chandeliers and brackets of various designs fitted with wires incased in lead tubing.

Lamps. A number of lamps were sent up from the factory to day in which the sealing of the wire was effected by first sealing a piece of fine drawn tubing about one half an inch long to the wire and then sealing the glass to the glass of inner bulb, allowing the glass on the wire to extend partly above and partly below the plane of the small bulb thus securing a longer seal with less liability of a check extending through sufficiently to admit air.

Rubber cloth. Two packages of rubber cloth in strips recd for winding cables etc.

Saturday Oct. 9-80

Interference. Edison vs Blake or Dolbear interference on telephones evidence continued to day

Gas Canvass. Mr. Russell brought to day the third book of canvass on gas power etc. So far has met with excellent results and obtained the desired information in all cases but one, that of a gas stock holder.

Call box. McKenzie to day prides himself on the entire completion of the call box and system in all its details, after nine weeks labor.

Work. Usual for past week. Factory has been turning out and Francis testing a considerable number of lamps. Work progressing nicely on the large dynamo. Dean and assistants still on clamp machine and fiber cutting clamps. Gang on insulating the street conductors. Carpenters on inside work of Factory supplemental building. Wm. (Moore) left for China and Japan

 Monday Oct 11. 80

Conductors. Another pair wires for lighting up lamps in the lamp case were run by Mail Free from Station to the Labratory.

Lamp. Holzer suggests a lamp what might be called pear shaped and to be received in that shape from the glass factory. As being cheaper and fully as nice a design as the shape now used. The bulb would be thicker and better for sealing in the inner tube & carbon.

Preparations are being made for lighting and testing about 100 of the factory lamps tonight.

Rubber lined pipe. A lot of three inch rubber lined iron pipe was received to day for experiments of insulating conductors therein.

Visitors. Frank McLaughlin here to day having arrived from California yesterday.

Tuesday Oct. 12. 1880

Building. Carpenters to day commenced work on a new building for black smith shop etc. 22 by 24 feet adjoining the old shop and carbon house.

Printing glass. A 3/8 in glass french plate two by three feet for use on the apparatus for blue printing process was received and a man grinding off the edges.

Commutator. The casting for the commutator base or core for the large dynamo was received and Logan turning it up in the large lathe.

Lamps. 98 lamps of the second hundred from the lamp factory were started about three o'clock this morning burning at an estimate of forty eight candles and about twenty remained whole and burning up to six oclock in the evening when the current was turned off and to have the remaining lamps retested for vacuum and resistance Nos 171 + 173

Photometer. Freeman finished a photometer apparatus for Mr. Batchelor to be used in Supplemental building at Lamp Factory.

Pump. Again to day suddenly stopped with twenty two lamps on vacuum pumps heated and nearly ready to seal off - several were destroyed and vacuum lost in all.

Gas. By mistake in putting oil in the wrong pipe of Combination Gas machine it has been working badly so that the Clark machine was again filled and has been supplying the gas for the Factory to day.

Lamp tests. The lamps that remained unbroken at six o'clock last evening about twenty in number were brought down stairs to be tested by Francis, results not figured out, no comparason yet made and memory does not serve him to tell whether the resistance and economy is higher or lower, since there were ...

Water. The water for engine is very low and running nights discontinued except on extra occasions.

Visitors. Gamble, General Supt. of Western Union Telegraph Co. San Francisco and E. W. Andrews President of American District Tel. Co. New York with a party of others.

Pear Shaped Lamp, one of the lamps with pear shaped globe was made by Holzer and sent to Laboratory this evening was burned awhile, generally conceded to be a better and nicer style than the oblong ones now generally made.

Water. Man digging trench for pipe leading into the pond about two feet deeper to more completely drain it.

Pear Shaped Globe. one barrel containing one gross of pear shaped globe for latest style of Lamp was rec'd at Factory to day.

Pump. Mr. Edison trying experiment of using water in regular vacuum pump to see whether it would act in producing vacuum, N.G. total failure.

Rotary Engine. New Rotary Engine West's patent Manufactured by Colts Arms Co, was tried to night, the engine of six horse power and calculated to make Seven hundred revolutions. run up to 800 Rev, engine empty and with low resistance lamp & six ohms resistance reduced the Revolutions to 680.

Gas Com. Mchn. Holzer, refilled the Combination Gas Machine properly and it is now working very nicely, whereas before the weight run down in 2 or 3 hours it now runs 24 and over.

Visitors. Mr. Baily — Esq. Wood.

Factory. Carpenters putting up partitions between the different departments down stair in the factory.

Papers. The present issue of the "Scientific American" of date Oct. 23.80. publishes plate and descriptions of Maxim's incandescent lamp. Dynamo Machine And current regulator, claiming the Dynamo to be capable of heating to incandescence 80 feet of No. 9 iron wire and to have maintained 64 lamps at 30 candle power each, and as estimated by Maxim to be capable of maintaining 200 of his Lamps. The regulator acts so accurately that in removing one by one of the Lamps until but one remained, the regulator so varied the current to suit the conditions that no perceptible difference could be

seen in the illuminating power of the last lamp or a single lamp at any time.

Patent on incandescent lamp granted Aug. 10. 1880. Process of Manufacturing carbons July 20.80 Dynamo Machine June 8.80 regulator June 8.80 and Process for charging the lamp with gasoline vapor Aug. 10, 1880. Interests identical with U. S. Elec Light Co.

Lamp case. A show case in first floor of Laboratory was filled with lamps ~~and let~~ which were lit at sixteen candles and allowed to burn all the time engine was running. The heat on the shelves and wood, work was very slight.

Water. Very Low. discussing, laying pipes and pumping from Edisons pond or brook down in gulley.

Gas carbons. Frances arranged an apparatus for heating carbons in gas or vapor of chloroform, ether etc.

Canvass. Mr. Russell to day sent out the fourth ~~book~~ canvass book filled with data on gas power etc.

Pumps. The double tier of vacuum pumps supplied by power pump were taken down and the supports set out from each other two inches on a side and the upper one lowered about six inches.

Visitors } A New York Public Official said
About } to be a member of board of Aldermen

Mr. Upton ~~spoke~~ at 12 o'clock to Philada.

Work general. Testing lamps by the quantity. Men on Large Dynamo. Gang of about twelve on Street conductors, Dean and assistants on clamp machine and clamps for cutting bamboo. Rotary engine received + partially tried.

Belt Pump. A power pump to run by belt was received to day probably to be used for pumping water from Pond or brook and to be operated by electro-motor.

Heater. A heater was also received for heating water for the boilers.

Meter. John Ott is changing the mechanical part of the balance meter so that when the rod or pointer connected with the balance shaft contacts on the different sides it reverses the current through the a pair of magnets causing a rod or arm passing between them to be repulsed or attracted and each movement of the arm by points on the extreme end propells a notched wheel which in turn imparts the motion to the mechanism of the box and to the hands of the dials thus registering every vibration of the balance

Draughting Room. The building for the draughtsmen was finished up to-day and they moving in.

Visitors Bergmann here and shown a resistance apparatus, probably for the purpose of drawing some of them.

Absent. Edison at New York all day. [illegible] at Philada and Upton at Princeton.

Brush Lamp. A Brush lamp was brought by Mr. Upton and burned awhile this morning put one ohm resistance in, to relieve the machine of so near a short circuit.

Pump. Mr. Batchelor experimenting on pumps and continued at it nearly all night amongst the most successful experiments was one of sealing off the fall tube about six inches below the gauge connecting tube and passing the mercury through the short connecting tube and down the gauge tube, the contraction having been made smaller. on this pump a very good vacuum was obtained in about fifteen minutes by running about one and a half pounds of mercury per minute

Lamp. One dozen inner-parts of lamps order with three wires sealed through the glass. probably to use two carbons

Chloroform Vapor. Francis heated some carbons in vapor of Chloroform and also of Bi Sulphide. the latter coated a little but the chloroform coated very nicely and evenly. carbons not yet put in lamps.

Visitors. Mr. Inman of Inman line of Steamers. was well pleased with our and talks as if there was no question about their adopting the light on their new Steamers.

Absent. Maj. Mc Laughlin bade good bye for his return to California to night.

C. P. Mott absent in New Brunswick all day on abstract for Johnson, Book 136 page 85 etc.

Steam pipes. A couple loads of steam pipes delivered at Lamp Factory for heating purposes.

Chlorine Gas. Francis trying some experiments on heating carbons in chlorine gas but unsuccessful in getting out any good specimens.

Resistance Box. finished yesterday and tested all right. It is composed of a lot of resistance spools secured to under side of board, on small table on top is a crank which being turned from point to point throws in or out a fraction or a number of ohms as the case may be. at each full revolution of the crank it enters a notch in a wheel and turns it sufficiently to throw in or out several ohms. Thus making so to speak a double resistance box.

Mica. A Number of large sheets of Mica received and by Cunningham secured on the core of the large commutator to insulate the stripe from the core.

Wood shrinkage. Johnson is boiling some spools of different woods in Alcohol and rosin, to determine the kind to use for sockets, subject to the least change or liability to warp or check.

Visitors Faber and a party of friends

Gasoline vapor. Francis secured a piece of gas pipe in one of the old nickel moulds, and introduced gasoline vapor after being well charged the moulds was placed in the furnace several of the first tests were unsuccessful from having been kept in to long and heated too much giving the carbons a wolley appearance. Some of the tests later in day when the mould was brought only to a red heat in the furnace the carbons came out coated more smoothly.

Brush Lamp. Mr. Upton making some experiments with lenses on the Brush ~~arc~~ Lamp to concentrate the heat on the clamps of the Edison lamp during the process of obtaining vacuum to assist in expelling the air from the clamps by means of the heat.

Pumps. Mr. Batchelor continuing experiments on pumps and sketch of one dispensing with the fall tube given Mott for Patent office drawing

Oct. 21. 80

Ideas sketched. Mr. Edison sketched two modes of attaching lamps to pumps and drying devices one for heating in a chamber connected to the pump a large piece of carbon to incandescence thus expelling the moisture by heat, the other device being a chemical ... similarly connected to pump. Two sketches of armatures, similar to the one the details of which were worked out by Clarke and one subject unknown dated and signed by himself the others dated and witnessed by C. P. Mott.

Disc Engine. Agent here and worked nearly half an hour to get it started found to be full of water in consequence of stoppage in small pipe for draining off the water.

Left. G. K. Boehm left, his position not consistant with his honor and truth

Friday Oct. 22-80

Arc Lamp. As one result of the experiments with the Bush Arc Lamp Mr Upton and Martin Force are laid off to day with painfully sore eyes.

Meter. current to two lamps is being passed through the balance meter connected to the box of recording dials made by Ott. Oct. 18. 1880.

Chlorine Gas. Experiments continued by Francis, no very favorable results. Book 104 page 175.

Water slight rain to day added a little water to the cistern and the power was run till twelve o'clock for Mr B. to continue his experiments on the pumps. the best results so far have been with the fall tube cut off about six inches below the cross tube and flowing the mercury down the gauge tube to which is attached as shown on ... measurement ...

Absent. Mr. Kruesi in New York all day
Mr. Upton gone home.
Visitors. Telephone man of Boston. Vail
Building. Black Smith Shop finished

Statement. Made copy of Mr. Edison's in
Interference Sawyer and Man vs Edison
in which he states that he experimented
with paper carbons in 1876 and applied
to electric lamp in 1878.

Canvass. Mr. Russell here to day and brought
the 5th book of gas & power canvass.

Patent copy. Made copy of Provisional and
Final English application for Patent on
Automatic signalling with Magneto electric
machines for Mr. Edison & Johnson.

Armature. Mr. Edison made sketch of a
new form of armature composed of discs
and spaces of cross plates or pieces which
was given to Mott from which to make
Patent Office drawings.

Visitors. Burbank the electrician and the
agent for Root Boiler.

Work general for past week. Carpenters finished
Black smith Shop. Dean made a start on the
large armature. Mr. Batchelor experimenting on
pumps. Gang on insulating cables, & Mr. Ott
at work on Meters. Draughtsmen all in new room.

Engine during yesterday Alfred gave the engine an overhauling and repacked both of them.

Pumps Eighteen of the new form of pump with gauge tube turned into the fall tube with drying vacuum and spark gauge tube attached are up and working very nicely.

Drying furnace the upper portion of a cylinder stove with perforated partition secured therein for holding the lamps over which it is intended to burn gas jets to keep the moisture out of the lamps before being placed on the pumps was set up in the factory to day.

Sketches In Book No. 60 pages 1 to 5 Mr Edison to day made sketches of several forms of lamps, shapes and kinds of carbons and means for heating them on the pump to exclude the air & moisture.

Carbon. Mr Edison and Francis are to day experimenting on building up and making carbons more homogeneous paper was soaked in tar and placed in mould. Napthaline gas was passed through the mould while in the furnace the paper carbonized hard, smooth, very homogeneous with a ring like a piece of steel. A lamp was then put on a pump and napthaline vessel connected with gauge tube. after passing the mercury for a time to remove a portion of the air and permit the gas to replace it, the loop was carefully heated by the current but at first gave every appearance of oxidization and was exceedingly irregular. after running the pump for a few minutes longer, the current was again applied and the loop gradually turned up and soon gave appearance of being entirely even. The inside of the globe was however also coated

the carbon was removed by Mr. Edison and found to be nicely coated and of good appearance under the Microscope and more tough or tenacious than the ordinary carbons. Several trials were then made of passing Napthaline through the moved, in the furnace, in which was placed Bamboo strips &c. but with indifferent and varying results.

Water. Lumber taken in the gulley and shelter erected for dynamo motor and pump for pumping water for the engine.

Visitors. Bailey of ~~Puskas and Bailey~~ Maj. Eaton and two gents on business in evening.

Heat at Factory. Pipe fitters are putting in steam heating pipes at Factory.

Carbons. Mr. Edison and Francis continuing experiments in coating carbons in Napthaline gas with fair results and ~~good~~ success except one explosion which they had prepared for, by placing the lamp in a box. See notes in Book No. 104 pages 178 &c.

Reflectors. two packages from the United States Reflector Co. opened and in early evening some interesting trials made on the electric lamp with them and with some of them very fine results were obtained in reflecting and concentrating the light.

Absent. Mr. Batchelor and Kruesi absent all day at Philada. report that the pump is well underway and a promise that it

will be shipped on Wednesday Nov 3. not so encouraging reports from the Engine but will have the bed plate in time to facilitate matters here and obviate any delay on the dynamo part.

Switch board. Mr McKenzie informs me that as telephone switch boards are at present constructed normally all lines are plugged on ground bar, necessitating ground plugs to be withdrawn from both lines and being inserted in the blank bar and that he has to day devised and sketched means whereby this may be accomplished by the withdrawal and insertion of but one plug by means of extra connections on the back of the board.

Gas Mould. Mr Andrews finished a model frame devised by Mr Batchelor for placing inside the large nickel moulds. the frame has a perforated bottom, on which is an open light frame and the longer cross pieces on top slightly notched each one capable of holding ten carbons or loops. A short piece of gas pipe is secured in the bottom of the mould through which sanguinated gas may be introduced in to the mould and pass through the perforated bottom of the frame and being there diffused and passed evenly around the loops after which it escapes through an aperature in the top of the flask. the object being to pass gas or vapor of any kind through the mould during carbonization or by reheating ~~after~~ the loops in the above described apparatus ~~after the~~ with gas or vapor passing through, after the primary carbonization

Armature. Dean commenced laying out the heads of the Armature on the cast iron plates prepared and for use thereon.

Lamp tests. Francis tested 40 lamps that were not sealed off the pumps until no spark could be seen in the spark gauge of the pumps with a 3/8" coil.

Conductors. Lines were run from Station to draughting building for light.

Factory. The chain pump was run to day for the carbon tester and about 45 carbons tested.

Sequeira. Dispatch received to day announcing his death in Havanna from Yellow fever.

Bast fiber. Dean commenced a cutting mould same principle as the ones in use but smaller in which Bast fiber may be worked.

Water Men putting up open trough from the Pond to an a sufficient elevation or gulley in which water may be pumped and run into the Pond.

Interference. Evidence is being taken in the office in the case of Heath & Bush vs Edison according to Edison, and Blake & Wilson according to Batchelor.

Cables. The 25 mile cable & its branches and Mr. Edison's line & branches are again insulated and ready for the lamps as I am informed by Howell.

Indicated. Mr Clarke indicated the Engine this evening with shop running as usual but the dinamo machines all open and found 10 H.P. was being taken for shop & shafting

Oct 28.

Shade holder The little frenchman finished a shade holder for Johnson composed of three arms with spurred ends and hinged at top to a fancy ornamental piece suitable to hold the socket of the lamp. below the top piece the arms are encircled with a ring which may be moved down on part of the arms which is made with a slight incline thus binding the arms toward each other and the spur under the flange of the shade, making a very neat and convenient fixture.

Friday Oct 29 80

Testers To day Mr. Batchelor struck the dodge of doing away with the combination of the testers with the pump direct and permanent by treating the testing globe as a separate vessel and placing it on the regular pump as a lamp, it may then be removed & the carbons put in and taken out by one man at his bench and thus avoid much danger of breakage both of glass and carbons.

Gasoline vapor Francis is still experimenting on heating carbons in vapor on the testing apparatus is today using gasoline and got off some few very fine appearing carbons. which Mr Edison directed him to have put in lamps for testing.

Water Dynamo taken to gulley for pump motor for pumping water for Engine

Visitors Maj Eaton. also Willie stopped a few minutes on way to Washington.

Albert Clarke started for home this a.m.

Pyramo Station Masons wedging between the walls and floor beams and cementing the space to stiffen the floor.

Large Armature. The long copper strips were received to day for the large armature.

Work general past week experiments conducted on heating carbons in gasses. Dean with assistants working on large armature and on mould for cutting bast fibre. Gang still on insulating conductors. John Ott finished wheel meter. in Gas fitters running steam piping at factory for heating purposes. Mr Batchelor experimenting on and having pumps changed to but one tube with dryer and spark gauge attachment. Men at work preparing to pump water from gulley.

Regulation Sketches of apparatus for regulating electro motion free by Mr Edison Book 60 pge 12 etc.

Street Lamps. on Monday night several lamps were put on line past Mr Edisons barn and lit up, and on Tuesday night the entire line along Turnpike from Carmans to Factory was supplied with lamps to burned till nearly 12 oclock. Burbank was here with stereoptican and tried it with the electric light, good but not quite powerful enough

Visitors. Bauman of Geneva with an interpreter here on Monday, Burbank on Tuesday.

Vulcanized fibre Bradley succeeded in cutting but a few strips from vulcanized fibre in the tools used for bamboo, which were given to Mr. Batchelor and as soon as a mould full can be cut. they will be carbonized and tried.

Tri-cylinder Engine. A Gardner Patent tri cylinder engine was received to day. small probably 5 or 6 horse power. not yet tried.

Motors and Meters. Sketches dated on Sunday made by Mr. Edison Book 60 pge 18 etc and also date Nov. 2. pge 45 etc. same book

Water pump. The motor taken to the gully for running the pump crossed with the base and was returned to the shop an armature with pulley was put on the locomotive and run down yesterday pump connected and raised water to the troughs, which were found to leak so that they were treated to more tar and to day the pump was permanently set to work and is flowing into the pond a stream estimated about 10 gals per M.
current from Dynamo driven by the loco engine

Telephone Station The telephone station up stairs in the Labratory was completed to day connecting all the instruments in the park in a regular system.

Absent C. P. Mott. absent at home from Saturday afternoon till Friday night

Gasoline Carbons. Six carbons treated in gasoline gas were taken to the Factory to be put in Lamps. Two put in and sent up were exhausted and broken by Francis before any test could be made or results noted.

Visitors. Buderman in company with inventor from Geneva. inventor of rock drill. Black Boiler agent. Mr. Painter. Senator McPherson and Lord Armitage.

Absent Holzer sent to Corning N.Y. to see about getting small Pear shaped lamp globes.

Gasoline Carbon. Balance of nickel carbons returned from Factory in lamps this morning part of which were exhausted on a pump in the Laboratory one tested at 16 candles took 3225 ft. lb. Book No. 121 pge 116. Mr. Edison tried carbonizing the raw bamboo in a hot glass tube having gasoline vapor passing through it, but it proved a failure. he and Francis worked very late on ~~carb~~ treating carbons and carbonizing in the furnace with nickel mould and gasses with varying success.

Balance Meter. John Ott finished a balance meter in which the plates of copper suspended from the ends are each immersed in separate rubber jars. it was set up for test in the Photometer room.

Rubber lined pipe another lot of rubber lined pipe for conductors was recd to day

Prints. Mott succeeded in making some very good prints by the blue process, by using the original Patent Office drawing and giving it a few days exposure this means would save the expense and labor of making tracings for that purpose.

Large Globes. The large globes were to day carried into the black smith shop and cleaned and the extra ones were taken in the shop and fitted to the posts by Andrus.

Interior ~~Improvements~~. Men commenced cleaning and painting interior of the Laboratory & all things removed from the shelves and cleaned and dusted preparatory for the painters.

Absent. Mr Batchelor at his house all day feeling considerably under the weather.

Canvass. Russell delivered another book of canvass in gas etc.

Saturday Nov. 6. 80

Rio Genio Bamboo. samples of Rio Genio Bamboo were recd to day. large coarse and green

Armature cores. Logan is turning lignum vitae cores for the Large Armature

Pond pump. The pump in gulley pumped into the Pond to day one & one half inches perpendicular raise in six hours.

Retd. Mr. Clarke returned to day after an absence since Oct 29.

Work general for past week. Upton & Hammer tabulating the statistics obtained by Mr. Russells canvass. Edison & Francis treating carbons in gasses. commenced putting out the Street Lamps. Dean & assistants on Armature. Cunningham on commutators for same. Ott on Meters. Several men in shop on Magnets &c of Large dynamo.

Sunday Nov. 7. 80

Work. Engine running and part of the men at work in shop. The pump boys at Factory also working the pumps by hand in the afternoon.

Water leaders. Sometime during last night the heavy wind blew down the whole length of open troughs erected to conduct the water from iron pipe of pump to the pond.

Carbonization. Mr. Batchelor is making some experiments in carbonizing. Bast Bamboo and Manilla Hemp in the furnace in the laboratory but with but partial success several of the nickel moulds melting on the inside and ruining the products. Mr. Edison had some inner parts made with four wires and clamps two of which clamped the ends and the other two about 1/4 of an inch up the carbon for experiments in building up the carbon between the clamps to make good end for permanent

clamping the first one tried was arranged so that the two ends were in multiple arc and one being a little longer than the other and consequently higher resistance they did not heat and accumulate in the gasoline vapor, and he directed the wires to be run in such manner that the ends desired for augmentation would be in series after which better results were obtained. Some carbons thus clamped were treated immersed in Kerosine oil and one placed in a lamp late during the night. Several staying up and working on the subject all night. The vulcanized fibre carbons did not pass well through the tests three only out of 13 proving satisfactory, they have not yet been put in lamps but appear well and are strong and leathery.

Reid Holzer returned on midnight train last night carrying with him a lot of glass for fall tubes of pumps

Tests Lamps. One lamp completed and with the carbon ends of same carbons built up in Kerosene last evening was tested by Francis but pronounced "no good" ~~the fault however probably being in the body of the carbon and due to the ... ... in that part.~~ He also tested the lamps sent from Factory as having been exhausted yesterday. An uncut Bast fibre was treated on the ends only and put in a lamp. sufficient current was put on to melt the copper wires leading thereto but without any perceptable injury to the carbon. it was then taken out and replaced in another lamp. The lamp first described in this note ~~is now ...~~ was from information received from Francis while testing. but later on inquiring the whereabouts of the second lamp inclosing the uncut Bast he acknowledges that to have been the lamp containing dry bast and that he does not know where he noted the results of the tests upon it. apparently testing for his exclusive information

Monday Nov. 8. 80

Interference. Evidence being taken here today on an telephone interference designated by Mr. Batchelor as the final telephone interference.

Dynamo bearings. One of the machines in dynamo room made the charge of Schmoyder heated in the bearing to red heat and loosened the brass bearing so that it was necessary to remove the armature the bearing remaining on the shaft. Schmoyder was relieved of his charge and given liberty to seek pastures new.

Illumination. Mr. Edison's house having been supplied with new wires & fixtures was again illuminated with the electric light

Tuesday Nov. 9. 1880

Interference Evidence on telephone interference being continued to day.

Water. The leaders which were blown down the other night, were repaired and replaced and the pump again set running to fill the pond.

Wednesday Nov. 10. 80.

Bamboo. Japanese bamboo, about one ton was received today but very damp and musty - bit of apparently good fine grain near outside.

Interference evidence still being taken.

Building carbon ends. Andrews finished a clamping holder for securing the ends of carbons so that the current may pass in at one end, thence along the carbon to the second clamp thence across to other end and out at the point or at same end. The instrument is composed of two

clamps on each side each of which are impinged against the underlaying carbon by small thumb screws, in which position it is in readiness to receive the treatment in vapor or suitable liquid.

Thursday Nov. 11

Evidence continued and Mr. Batchelor and Mart Force searching for the original iron transmitter.

Friday Nov. 12. 80

Evidence continued.

Balance Meter. Nichols experimenting on the balance meter and is exceedingly well pleased with its accuracy and prompt action.

Dull. The heads are and have been during the week almost exclusively engaged in the Interference case, and no experimental work has been done or devices planned.

Heated Lamp. Atkinson set up the arc lamp in the dynamo room and by two reflectors focussed the heat thereof on a lamp in open air and very readily heated it red hot.

Bed Plate. The bed plate of the Porter Allen Engine and large dynamo weighing 8400 pounds was delivered at the depot to day.

Burbank. A small engine and boiler sent here by Burbank to determine whether it would run one of the smallest dynamos with sufficient power to produce good lights for his Stereoptican, was set up in the Laboratory and run under one hundred pounds steam pressure, the small dynamo was attached but reduced the speed very much when work given it.

Work general of past week. Messrs Batchelor & Edison engaged principally on Interference case. Little doing at Factory in consequence of delay in getting the seein pump. Men in shop pushing work on large dynamo & armature. Ott at work on an Electric dynamometer.

New Mould. Andrus finished a new mould made deep to carbonize 100-12 carbons at a time. The tubes are [illegible]

[illegible] and delivered to be built up afterwards

 Sunday Nov. 14. 80

Water heater. The heater for the boiler water was set up in position today and put in use about eleven in evening at which time the fires were started.

Room. The top of ~~wall~~ door leading from machine shop to dynamo room was enlarged and arched probably to make room for better handling heavy machinery &c.

Carbonization Andrews filled the new mould with straight fibres getting 144 in nicely. Later Francis started fire in furnace but in handling the mould shook up and slid the weights about so that the carbons were of no use, crooked and misshapen.

Gardner Engine. The three cylinder Gardner Eng was run empty awhile at night runs quietly and ~~smoothe~~.

Visitors Maj. Wilber and family also a Mining Man whose name could not learn.

Monday Nov. 15. 80

Bed plate The bed plate for the Porter Allen Engine and dynamo was brought from the depot and gotten safely in the machine shop.

Hot clamp Acheson today focused the arc lamp on one of the clamps of one of Edison Lamps sealed in the vacuum and heated it to red, but about that time the glass melted and the Atmospheric pressure forced it in making a hole through the globe.

E. L. Co. The directors of the Edison Electric Light Co. held a meeting here this evening.

Visitors Reporter of New York Herald and some other gentleman interested in the Light Co. and nervous over the progress of Maxim and the United States Elec Light Co.

 Tuesday Nov. 16. 1880

Bast fibre. A load of fine Bast fibre was received at the Factory to day.

Meter. Nichols to day runs the meters in ice and found it to work faster afterwards by steam heated the water surrounding the cup and the reverse in the action of the meter was the result he got the curve by the thermometer & thinks he can by proper resistances at the different temperatures make the action uniform.

Carbons. Mr. Edison and Upton are testing the resistance of some Bast and Bamboo carbons that have not been subjected to heat in the lamps. vary from 400 or 500 up to 2000. Book No. 106 page 63 &c.

Heat Factory The plumbers set up the boiler and turned steam into the pipes at the Factory to day.

Nov. 16. 80

Telegraph. The Western Union wires were to day changed from the Office to front upstairs Laboratory.

Man Power. The large crank which was put up in the dynamo room and belted to the dynamo machine with small pulley used for pump circuit, one man at the crank let four small lamps and the Bush Arc lamp.

Upton. Mr. Upton returned after an absence since Saturday, family used with him.

Papers. Sun and other papers of to day give some extracts of a lecture delivered by Prof. Morton in which he claims greater economy and stability for the Maxim Lamp than the Edison but acknowledges the superior efficiency of the Edison generator over all others. The Boston Journal of Nov. 10. brought by Mr. Upton yesterday contains a lengthy and fair unprejudiced article on the works &c. of Mr. Edison's. Puck of this week takes off the light with tallow candles and the rail road with a hand car driven by man power.

Engine foundation Men are removing the soil from under the end of engine room, for laying a solid foundation for the Porter Allen engine and dynamo.

Bast fibres Herig is experimenting on Bast fibres in acids and various solutions to soften & remove gum &c without damage to the fibre Book 125 page 1 etc.

Light wires. Cables were to day wound & entrenched in the Laboratory Lot for the Lamp posts and also run through under the rail road near depot and four of the large posts & globes set in there.

Sockets. A box of wooden Lamp sockets and brass screws etc. for finishing them, were rec'd. to day

Weight of 6 Six carbons which were carbonized

Carbons in 15 minutes with a equal number that were heated very slowly and took 3 hours in carbonization were weighed carefully and it was found that those carbonized quickly lost about 12 per ct. more carbon than those slowly heated indicating that the loops carbonized by quick heat are more porous and liable to internal arcing than the more homogeneous ones treated by slow heat.

Bast carbons. Some carefully made lamps with Bast carbons were tested and gave about 142 ohms at 16c. and were very even in economy. Book 124 page 15 etc. The lamps were set burning in the case in Labratory at about 16 candles

Paper. Herald to day publishes an article on the Maxim lamp together with an interview with Mr. Edison on the subject nothing very striking.

Fiber. A package of dark, fine, strong, hairy appearing fiber was received to day from New York. has been tried before, but want to give it a more thorough test.

Building carbons. Having connected evaporating tube with pump. in tube placed zinc and Sulphuric Acid and tried it on the carbon in a lamp. but was unsuccessful in desirable results. built one up with gasoline (christolized) and burned at 30 candles about one hour raised to an estimated power of 350 c. lasted 4 1/2 minutes Book No. 125 pg 3. etc

Friday Nov. 19. 80

Papers. The Scientific American of this week date of Nov. 17. contains very good Article on the progress made in incandescing lighting and very justly gives Mr. Edison the credit of being the pioneer in that branch of lighting and rather ridicules the both sided course taken by many scientific men and particularly English Papers.

Elec. Dynamometer. John Ott finished the Electric Dynamometer on which he has been at work for some time and delivered it in the Labratory.

Engine foundation, the floor of the engine room was removed the shape of the bed plate of the Porter Allen engine in a strip about six inches wide and masons will work all right on the foundation walls.

Nov. 19. 80

Iodine & Naphtaline } Some Iodine was put in a lamp and after exhaustion vaporized by heating the carbon. The vapor however attacked and destroyed the carbon near the clamps. pronounced no good. Later in evening Naphtaline and the chrystals of Naphtaline were tried, the chrystals giving a smoother and more perfect coating and building.

Mercury. In the experiments on the pumps and lamps at the Factory last night the working of the mercury indicated impurities and on careful examination it was found to contain quite quantities of Plaster Paris which had been used as a drier in cleaning. Salt is now again used and believed to be a much more satisfactory drying element to use in the process of cleaning.

Saturday Nov. 20 80

Street cables. The cables to street lamps except about 1000 feet, again wound and relaid and lumber of shelter piled up finishing all work on the lines for present. The last winding and insulation was commenced Sept 23rd and has employed an average of about twelve men on the work proper.

Paper. Prof. Morton publishes a card in "the Sun" to the effect that their report of his lecture published on Nov 17th was a mass of error or misrepresentations by their reporter, but does ~~not~~ state in what particulars it is incorrect.

Large dynamo. The polar extensions of the magnets of large dynamo were placed on the large lathe preparatory to boring out the holes

Spark keys. The single point spark keys used on the pumps were found to deteriorate rapidly in consequence of the spark at single

contact point. Mr. Batchelor in consequence is having Charley Flammer make a lot with double points to replace those now used.

Hot Mercury. Mr. Batchelor had tape put on an iron bottle in which mercury is transported and secured it so as to turn a gas jet under it and heat the mercury to 85 or 90 degrees. The plan was found to give much quicker and perfect vacuum and improve the general working of the mercury.

Work general. Mach work. Bed plate for Dynamo Engine placed in shop and some preliminary fitting of the parts effected. Discs secured on the armature shaft and work on the commutator etc. progressing satisfactorily under Dean. Messrs Edison & Batchelor experimenting at factory on times for subjecting fibre to process of carbonization, on lengths of time and heat to apply to lamp on pumps, and on heating mercury and pumps. Mr. Clarke working on the relation and laws of motors to machine etc. Acheson on autom

carbon by Electrolysis

Factory. during yesterday men were at work all day at the factory putting up heating and spare wires and putting iron stop cocks in all the top pipes leading to the pumps.

Carbonizing mould. Andrews finished yesterday a carbonizing mould with a round piece secured in the one end of the depressed center and small weights to be secured on the ends of the fibre the plate of moulds is then rivited to secured upright on the bottom piece of the flask and the fibres pass around the round piece and ends hang down with weights secured thereto. was tried last night by Mr Batchelor. but he found an alteration necessary in the weights by which they slightly bend the ends and prevent the weights slipping off by the shrinkage of the carbon.

Engine. fresh packing was put in the cylinder of the engine yesterday by Alfred but so heated this morning that some delay was caused by stopping to repair.

(Since 19)

Buck eye. Mr Clarke is at work on the details and proportions of a dynamo for a Buck eye Engine to run 150 Rev which he informs me is being made for the test or trial see B 116 & 121 etc

Electrolysis deposit carbon } Acheson is making some experiments to get a carbon deposit by electrolysis. although he has obtained slight deposits nothing definite or positive has been obtained to warrant hope of success.

Magnetism force } Messrs Upton and Clarke made an experiment to determine whether the zinc plate or lead in the large dynamos could be dispensed with. Three small bars of iron were secured against the polar extensions and the yoke a cross piece on top of the poles and the galvanometer indicated a decrease of two volts in the current due to the presence and contact of the bars

Papers. Herald has a short notice among the foreign items of the fact that the original or first Edison incandescent lamp is now exhibited in the Patent Museum at South Kensington, (Given by Mr. Edison to Col Stewart Writer Manager, at time of his visit here Sept 15.)

Annealer. One of the machines made for heating glass preparatory to blowing into globes (described May 28) was applied to annealing the outside seal of the lamps and is a very satisfactory apparatus for that purpose.

Heat. The boiler at Factory was insufficient in its production of steam, and today a blast pipe was connected with the fire box. The blast run the steam up very quickly but took too much air from the blasts of the glass blowers, the fire blast will probably be reduced to a constant one half or an inch supply instead of free three inch, the present pipe capacity.

Papers The Evening Post of yesterday publishes a Reporter's Interview with Prof. Barker in which the Prof. says that Edison's lamp is twenty years old, and that Maxim has found and now has what Edison has been looking for during two years past. (For consistency see paper of March 25. Also entry herein March 26.)

Armature. Dean tried saw for cutting out the large copper discs into proper strips etc. on the small planer but found it not sufficiently solid and is now preparing to arrange it on the lathe used in cutting the zinc.

Visitors Maj Wilber here with an assistant from his office both at work on specifications some thirty cases of which the drawings have been prepared for by Mott and are awaiting the attention of the Major

High Vacuum. Last night six Bamboo Lamps were sent to the Laboratory for experiments on high vacuum. Two were exhausted during the night by the pump here and burned about three hours before sealing off. It was observed that the vapory blue could be produced at the clamp, even when burning at low heat by holding a magnet near the glass and that as the vacuum improved the magnet required to be brought in closer proximity with the clamp to reproduce the blue, and the lamps were kept on the pump until no efflorescence could be produced by the aid of a strong magnet. They were tested by Francis and found very economical and were perfect in appearance.

Belt Strain. Mr. Clarke in his investigations of the relations between generator and motor establishes or rather discovers the fact that in machines of the same construction the strain of the belt driving the dynamo and

the strain on the belt from the motor to the driven machinery will be the same, when doing their maximum work, regardless of the speed or external resistance or loss on the lines.

Chemically treated carbons } Fountain carbons were treated chemically by Dr. Haid to remove all organic and foreign matter. Comparatively a small amount of impurities were found yet enough to possibly be deleterious. The carbons were then sent to the factory to be measured and those of suitable resistance sealed in lamps to be returned to the Laboratory for exhaustion and test.

Condenser in Lamp } Hammer made small condensers of alternate sheets of mica and foil connected with wires of lamp below the clamps. sent to factory to be put in and exhausted.

Visitors. Reporter of Tribune, shown around and explanations given him by Mr. Edison. Also Biederman & friend.

Thursday Nov. 25. 1880.

High Vacuum. Last night Mr. Edison, Herig and assistant run a pump on a lamp until about three oclock this morning when no blue could be brought to the lamp by a powerful magnet and were about ready to seal off when all dropped asleep lost their vacuum and lamp.

Absent. Snowing all day this Thanksgiving B. D. Mott, Nicols, Acheson, Hammer and several others absent from Park still more absent from Works. Dull quiet.

Friday Nov. 26. 1880.

Papers. Tribune to day publishes the interview of their reporter with Mr. Edison which in the main is a correct report. They do not however go much outside the statements of Mr. Edison. Evening Express interview of Sawyer favorable to Edison and his success anti Sawyer.

Factory. Partition put up in second story dividing the mercury department from the clamping do. Glass Blower removing the carbons from four or five hundred lamps in which they had been secured by clamps other than Platinum to put them in Platinum clamps and Pear shaped globe with wires through the flat seal. The iron pipes for power pump all in place and the boys are running mercury through carrying considerable dirt and dust each time.

Buckeye. Mr. Clarke is preparing a contract with binding specifications for signature of the Buckeye engine Co. previous to their building the 450 hp. engine for experiment and use here or elsewhere on large dynamos.

Armature. Dean tried his machine attachment for bending the copper strips in form for the armature and finds it to work very satisfactorily

High vacuum, Engine run all nearly all night again for current for the experiment in the Laboratory on high vacuum, one lamp, gotten off the pump with exceedingly high vacuum. in which a powerful magnet produced the blue in the form of a vapor or diffused halloa around the Platinum wires

Decorations. Mott made a bracket and small light socket from rubber scrap small and airy, and was requested by Mr. Edison to work it up in economical commercial form.

Glass- Six tierces and three boxes of Globes and tubing received from the Corning Glass works this morning.

Water Engine Not running this morning in consequence of water. The Pump in gulley started and about eleven oclock water enough had been pumped in the pond to warrant starting up.

Papers The times to day publishes two articles touching upon Edison and the electric light. The one intimating that all substances tried for carbons so far have been unsuccessful and that the perfection of the carbon and lamp depends on the discovery or use of some other vegitable production not yet tried by him and that Mr. Brannen will sail for Para on Dec. 4 in the City of Para to gather and foward from Brazil all her fibrous woods vines grasses &c.

The other is a short editorial stating that Morton and Bailey claim only for Maxim the invention of using gasoline vapor in lamps as something of great value if not entirely essential to the perfection of an electric lamp and further that although Profs. Edison and Sawyer accuse him of stealing and copying from them, they have not stated in what particular nor dates when they used or devised any of his claims.

Absent C. P. Mott left for home at 11 20 A.M.

Work general of past week. Mr. Batchelor and assistants preparing the pumps and pipes for the power pump and clean mercury. Mr. Edison with two or three assistants making experiments on high vacuum on pumps in Laboratory. Dean and several assistants pushing work on the large armature. Logan and others on Magnets. Frame etc. of large dynamo.

Returned C. P. Mott returned from visit home at midnight last night.

Visitors learn that Sarah Bernhardt was on visit at Laboratory on Sunday. To day Norvin Green Goddard and several others.

Carbon carrying. I find in Book No. 123 page 93 the sketches and notes made on the 28 & 29 Nov. by Mr. Edison of ways and means to prevent or compensate for the carbon carrying over, on the loops. One of which is a tapering loop. for this subject see also June 16 under head "Spectroscopic Best carbons".

Interference. Evidence which was commenced on Monday on Quadruplex interference is being continued today in the Office.

Coal dust Men were sent here and on Sunday prepared the fire box of Boiler for grates for burning dust coal, with intention of making an experiment of burning it directly under the boiler.

 Dec 1. 1880

Chemically treated carbons. Part of The carbons treated by Dr. Haid mentioned under date Nov. 24 which were taken to the factory were put in lamps and sent up here, and exhausted Monday night the treatment, so far as I can learn, was not considered beneficial, at least not enough so to warrant the labor of treatment.

Buckeye Contract. Mr. Clarke finished the contract between Buckeye Engine Co and Edison Electric Light Co. ready for signatures and duplicate commenced by C. P. Mott - covering 18 pages.

Thursday Dec 2 1880

Absent. Mr. Clarke went to New York carrying with him the contract with Buckeye Eng. Co. intending to go thence to Philada.

Papers. "Tribune" publishes a letter of L. Bohm denying the assertion of Mr. Edison that he is a boy of seventeen or was enticed away by Mr. Mason.

Vacuum experiments. All experimental lamps, and pumps used at Laboratory on experiments on high vacuum were removed to the Factory and Herrig & his assistant will, under the direction of Mr. Edison, continue the experiments.

Electrolysis. Acheson in trying Alcohol as a solution in his experiments in depositing carbon by electrolysis was unable to get any action, he then let it stand in lime a short time after which gas was freely formed in the solution.

Large Armature. Logan has turned off the discs of the Large armature and to day commenced the grinding and finishing with emery wheel.

Factory. Steam pipes are now run parallel with and adjoining the upper iron mercury pipes and the two wrapped with asbestos ~~to heat the mercury~~ for one tier of pumps to heat the mercury, and for resistance additional to the boxes already in. The lamps are enclosed in a tight box & thrown in or out by plugs from outside.

Letter press received. also Bill heads and letter paper with heading The Edison Electric Lamp Company. T. A. Edison Chas Batchelor F. R. Upton. E. H Johnson.

Rails test. The rails of electric Rail way, through which the current is conducted to the pump motor in the gully, were tested by Mr. Upton and found to be down to 24 ohms. Still the motor runs and does its work.

Hydraulic press. The small tri cylinder engine was moved from the dynamo room into the Laboratory and connected up and with the pump of the Hydraulic press, to use it for pressing the ends of the copper bars of the Large armature.

Vacuum. The five hundred pumps made ~~last winter and~~ spring have all been changed, broken, altered and abandoned, and the glass blowers are now at work on an order for two hundred without spark, or McLeod gauge, but single ~~tube~~ with dryer reservoir and probably to be tested for vacuum by magnet and "blue". Consequently the

Spark keys and wires were abandoned and taken down. Herrig to day moved in small room in the supplemental building and is continuing his high vacuum experiments. has to day very large globe encasing the regular carbon to exhaust for observations in the effect on carbon carrying. Francis is also making some experiments on pumps and vacuum in the small front room of Laboratory. has on trial a pump with two fall tubes in which the mercury is conducted from a small reservoir into which it is also deposited through a fall tube with contraction thus getting a vacuum on the mercury before its final use for exhausting the lamp. to day results unsatisfactory.

Conductors the light lines to factory were to day increased in capacity by the addition of extra No 10 wire as far as R.R. crossing

Papers "Sun" contains short foreign dispatch to effect that judgment was deferred in the case of Post Office Department vs The Edison Telephone Co. of London.

Returned Mr Clarke returned from Philada. this afternoon and reports the probability of the Porter Allen engine being shipped the last of the coming week

Pump. The screw pump for mercury ordered of Morris & Tasker by Mr Kruesi personally Sept. 25 was received in car on the switch to day.

Gasoline Hammer carbonized extra loop shaped wide card board and is introducing gasoline vapor in the bell of the hand air pump and passing the current through a regular loop passed placed therein on the wide carbon and is getting very nice coatings and fine appearing carbons.

Work general past week. work on large dynamo. Glass blower making pumps. Mr Batchelor prepared for pony pumps: Mr Edison experimenting on high vac. and lamps

 Monday Decr 6th 80

Paper. The "Sun" of Sunday has report of interview with T. A. Edison again giving twenty days from date as the time for the demonstration with Porter Allen engine and large dynamo.

Small dynamo. The armature of one of the small dynamos or motors was rewound with four wires of fine connected up for running as generator at the factory for current for testing etc.

Visual Indicator. McKenzie is making some experiments on working Ponds visual indicator with a magneto call and thus avoid the use of batteries in subscribers houses. He succeeds in operating the indicator every time by the magneto but as yet has not been able to get the desired combination with certainty.

Motor The dynamo machine standing, unused, in consequence of error in armature, up stairs in Factory was to day brought

up to be used as motor for running blower for boiler room for burning dust coal.

Pumps Men cleaning the power pump, and Mr. Edison making experiments on the vacuum pumps. The feature therein occupying their attention being an arrangement by which the contraction is in a separate tube and may be removed cleaned, or replaced without injury to the pump or the necessity of taking it down. A tube of small diameter is contracted at a suitable point, preferably near the lower extremity and is passed down into the tube when the mercury is introduced, the upper end passes through a rubber cork ~~is sealed in Mercury~~ fitted in the lower end of a reservoir formed like the testing globe in which the mercury is placed and by passing down the small tube is deposited without dropping into the lower end of first or conducting tube and thence through the cross tube which is slightly enlarged near the outflow, and thence in and down the outflow tube carrying the air with it.

Absent Clarke in N.Y.

Mercury cleaning. Dave Hickman ground a quantity of glass for filtering mercury; tried it in a tube and found it answered admirably. Dr Haid also cleaned some very thoroughly by severe shaking and then filtering through paper funnel, these operations are suitable only for removing mechanical impurities. Dr holds that the thorough shaking concentrates the impurities and which are then more readily removed by the paper filter.

Pumps. The extra tube contraction did not get down to fine work so completely as the Batchelor standard pump and will probably not cause any change to be made in the order to glass blowers to make 200 of the standards. Power pump gotten in position and nearly ready to start.

Electric Dynamometer entirely completed with mirror scale etc. and a thorough test made of its reliability by Mr Nichols.

reverse currents either direct or through the coils in their respective sphere give same deflection on the scale either right or left and is believed by him to be both valuable and reliable for station uses.

Silver Solder. Dean made a commencement in soldering the parts of large armature with silver solder and got good results on a couple after considerable trouble the heat not being intense enough, with the four burners from the supply pipe, and blast of fan blower. Other gas connections will be made and an effort to get better blast.

Interference. evidence again being taken again in Quadruplex interference and Serrell here with Wilber

Silver soldering. Dean abandoned gas as a means of silver soldering the parts of large armature, and is having better success with charcoal fire.

Loss by local current of Mchns } Mr. Clarke is making measurements etc to determine the loss in the dynamos by local cutting or currents and friction. He uses one machine as generator and one as motor or driven machine, taking the amount of current generated and speeds of machines he then reverses the machines as to motor and generator to get the mean or average. The laws of generator and motor with relation to each other have been so thoroughly demonstrated as reliable that this means of determing the loss by local current is considered perfectly reliable

Interference evidence still being taken in the quadruplex case.

Lamp. Holzer to day showed me a lamp that was made yesterday by Hipple in which the tube for exhausting was passed through the inner tube and sealed through it between the clamps and the point of sealing with outer globe and doing away with the tube on top of globe, after vacuum is obtained the tube is sealed off even with the lower end of inner tube and there does not show as part of the lamp. difficult to make however, and for that reason probably impractible

Screw pump. run to day, with mercury pipes being connected only from one reservoir to the other. Although run at slow speed it passed the mercury up very nicely and very encouraging results are reasonably expected.

Vacuum pumps some have been provided with tube shaped reservoir containing ground glass through which the mercury will pass into the exhaust tubes

Interference. Evidence resumed in the general telephone interference case.

Papers. The American Machinist of this week speaks of Maxims lamp as accomplishing the results sought for by Mr. Edison and states that the gasoline vapor is removed after the carbon has been heated and built up at weak points.

Telephones. Mr. Bergmann brought out a couple telephones constructed to receive the sounds from greater distances from the mouthpiece. they were put up and tested by McKenzie, would receive and communicate the sounds at a greater distance from transmitter than the ordinary telephone and are a neat instrument the diaphram being placed near the back of instrument and the funnel shaped mouth piece all sunk in or inclosed in the case.

Horse test. Berdemans engineer making test of generator. used No 10 wire on the commutator to see whether he had a current — got it. used waste and thermometer to get heat of armature while engine stopped to oil. on restarting succeeded in getting the thermometer and fingers out but the waste was lost and so was armature — use by him of the machines delayed Mr. Clarke in completing his measurements of loss by local cutting etc.

Screw pump. Pipe connections all made and pump carrying abundance of mercury at low speed and with apparently little power, it is believed the pump will supply mercury for 500 vacuum pumps.

Papers. Truth hails the introduction or proposed introduction of the Brush light on part of Brodway as a grand Christmas gift to the citizens of New York, says that no one now expects the Edison Lamp to do household duty, but thinks that some one will produce one for that purpose.

Large Magnets. Logan finished winding with 6 layers of double wound No. 10 wire and mounted one of the magnets of large dynamo on its base.

Sealing off. A spirit lamp was arranged with a goose neck glass tube, secured in a bracket mounted on the neck of the lamp, with a small rubber hose attached for sealing off lamps with straight exhausting tubes, sent to the Factory.

Visitors Dale, agent of the Inman line of Steamers. is anxious to have Mr. Edison put the lights in their new Steamer "City of Rome" and took socket

of electric lamp in which to fit the oil lamps. and make them interchangeable.

Screw pump. have been most of the day running mercury through the pump and pipes for cleaning them and are getting them in pretty fair order.

Absent Mr. Edison has not appeared about the factory or any works to day

Case Lamps. The last of the eight best lamps in case broke in carbon to day after burning 211 hours

Field & E.M.F. Mr. Clarke made tests of saturation and comparative test of current on field and on line Book No. 116, page 157 etc. Most economical current on the magnets was 3789. ft pounds or 7.6 Webers which gave saturation, and after that point current added to the magnets gave very little increase in current.

Saturday Dec. 11. 1880.

Carbon deposit. Hammer and Howell are making further experiments in depositing carbons from gasoline vapor in the Mechanical vacuum pump. The loops are laid on wider strips of card board carbon in the bell of the pump and ~~after getting~~ gasoline is introduced. They have got slight deposits on the loops, but so far have not got it on the clamp where most desired

Electric Dynamometer. Mr. Nichols determined the constants of the low resistance dynamometer, and made scale from which the economy of a lamp may be read. Book No. 118 pge 47 &c.

Grate bars. the grate for burning coal dust were secured to day and fires let down at five o'clock for putting them in and making the change.

Visitors Reld. Lawson put in his appearance this morning having arrived from Colorado late last night.

Work general of past week. Screw Mercury pump put up and repaired ready for work. Work in shop progressing on large dynamo. Logan winding cores of magnets. Hind &c. on a Meter with four Mercury cups for contacts. McKenzie trying to work call box with magneto current generated by the magneto call box of Johnson. Mr. Clarke making measurements to determine the loss in dynamo by local cutting. Nichols determining the constants for the low resistance Electric dynamometer.

Double loop lamp. Mr. Edison had lamp made with two loops clamped in same clamps but standing apart. on heating it the loops further separated contrary to expectation under the law that like currents attract.

Coal dust Exp. Grate bars and discs for burning dust coal, were put in yesterday but blower not ready and coarse coal being used.

1 H.P. Motor. One of the small machines mounted as a motor by Bergmann was received but several changes found necessary before trial can be made

1/4, 1/3 & 1/2 lamps. Mr. Edison had some lamps made with carbons 1/4 1/3 & 1/2 length of the regulars, for use in series or instead of one across in multiple arc. one of 1/4 and one of 1/3 lengths where exhausted and intensely heated, vacuum was obtained on them in 35 to 40 minutes the globe etc being small

Screw pump. doing regular work to day and a number of lamps exhausted. one tier of vacuum pumps was completed and arrangements made for running through all the lamps possible tonight. The lamps are connected by the straight

exhaust tubes and sealed off by the blow pipe spirit lamp (Decr 10) which works very satisfactory

Photometer. Mr. Upton to day brought two student lamps with incombustible burners one to be used in the photometer for the factory, the candle power as tested by Francis was twelve. Chas Flammer finished the photometer and secured the lamp thereto and it was blackened and taken to the Factory.

Visitors Mr. Lowrey and Son here in the evening.

Produce Vacuum. I find in book No. 106 page 85 under date Nov. 17. sketch and description by Mr. Batchelor of idea of obtaining vacuum by heating carbon in a globe to which is connected by tube with stop cock a lamp, also a second tube with cock unconnected, heat carbon expell the air through the latter, when its cock is turned and communication with lamp opened, to allow the carbon to absorb gases & air admitted from lamp.

Factory lamps. Excellent success was had at the factory during the night, up till two oclock when the engine was stopped for negligence or carelessness in the attendant in not supplying water. About twenty lamps ~~and~~ twelve pumps were broken by the sudden loss of vacuum. Martin Lees discharged for the accident.

Coal dust. Blast driven by the electric motor was started under the boilers and fire started ~~fired up~~ with dust coal, worked very well until about noon the motor did not work properly and fire got very low, but brought up and burning good the balance of the day.

Papers. "Truth" to day devotes a column to the Brush Arc light and the prospect of lighting Brodway from 14th to 34th Sts with 22-2,000 candle power lamps on 25 foot posts. supplied by current from 5 dynamos. driven by a Corliss Engine. Winds up with a slight rap at Mr. Edison for having told an appointed Committee man. that if he wanted light right away he had better get some other.

Visitors. Prof. Praeger with two ladies.

Photometer put up on track near the pumps to test the lamps before sealing off. All the lamps are now heated quite hot before placing them on the pumps. by which it is found that vacuum may be gotten much quicker.

Measuring box. By a misunderstanding between Clarke and Dehl a very heavy current was put through the resistance box. and a larger proportion of the coils destroyed.

Local loss. Mr. Clarke finished one test & measurement of the loss on the machines by local currents and friction. The total local loss he found to be about 15.000 foot pounds or a little under ½ h. p. has not yet determined how much is due to friction but thinks the greater portion is by the friction. Will make another test for comparison and proof. Book No. 116 page 161 etc.

Electrolysis Achison is still continuing the experiments to deposit carbon by electrolysis but has as yet obtained no favorable results. Book No. 155 page 1 etc.

Carbon plating Lawson, called to the Factory and set at work on plating the ends of carbons with copper etc. in small room in Supplemental building

Sockets. George Hickman is at work boiling the lamp sockets in Alcohol and rosin. giving them an oiled appearance

¼ lamp. The lamp with carbon of one fourth length was burned at 16 candles for a time then put in series with the one third carbon and the two raised to 32 candles. The ¼ was then put at 24 candles and burned 2½ hours before breaking.

Visitors Mr. Biederman says Maxim knows all that is being done here even to the number of working pumps and lamps taken off.

Thursday Dec. 16. 80.

Small dynamo. One of the small dynamos wound for the purpose, was taken to the factory to be driven as a generator by one of the motors there, to give current for testing and use at pumps

Interior decorations. John Ott finished & tried a ~~dive jointed~~ bracket with two joints which might be turned completely around without effecting the current or connections. It is quite ornamental and worked very satisfactorily.

1/3 lamp. The lamp made with one third length carbon was put on Photometer at 24 candles last night and burned 16 1/2 hours.

Pump supports, Moffett suggested and tried supporting the pumps by placing a ~~mort~~ piece of timber at the bottom mortised to receive the tenonted end of pump board, and spring clamps to hold the top. The top in trial was however

held by a hook shaped clutch secured on the board which took into a half slotted piece secured on the supporting timber. The idea met with favor and will be adopted.

Small Elec. Engine. The one horse power engine mounted by Bergmann was tried last night but no power could be had from it. Some defect which the electricians could not discover although working on it till twelve thirty.

Absent. Acheson sent to Greenpoint to the petroleum distilleries for the products remaining after distillation brought six products. One of crude oil, one of the tar 2 of coke 2 of wax. All differing greatly in appearance and body.

Water. Water supply exhausted and Ayers with team drawing from the brook all day.

Dynamo Station. Acheson is twisting cable for coupling the machines in Multiple Arc for the lamp lines, introducing a no 10 wire from each machine of a line, or about five machines to each pair cables.

Vac Pumps. forty six pump comprising one line was completed to day, and all the pumps working on lamps. about six oclock 44 lamps were put on, and exhausted very satisfactory.

Plating Lawson is plating the carbon ends at about eight an hour, and Henry is conducting experiments for uniting the wire and carbons direct by plating them together without manufactured clamps

Small dynamo. The small dynamo at the factory for current for testing is run from counter shaft driven by the blower motor. does not give so much current as expected but enough for the purpose.

Gas Furnace. Mr. Andrews finished a model of the gas furnace, for Patent Office: they in this case requiring a model.

Papers. "Evening Post" gives another column to Brush and his lamp and experiment in Brodway.

one horse power. The engine mounted by Electric Engine) Bergmann, was again tried but no go. Mr Edison found the bug in the winding of the Arm Magnets and corrected it by connecting top with bottom ends after which it was belted to a lathe and run a six inch saw through one inch copper bars at fast speed occasionally slipping the belt, but did not stop. the power engine was not determined.

Work general for the past week. In the shop work has been pushed forward on the large dynamo. And Ott finishing up lamp sockets. At the Factory the glass blowers on pumps and lamps. and Moffett mounting and putting up. new device for securing the pumps adopted, and the castings ordered. Lawson working on plating the ends

of carbons and Herrig experimenting on plating carbon and wire together. Second experiment on burning dust coal direct under boilers tried and so far with fair success. Lamps being tested and put on the lines preparatory to illumination on Sunday and Monday nights.

Blower power. The electric motor taken out of boiler room and small upright engine set up to run the blower.

Illumination: 143 outside and about 49 inside, making a total of 181 lamps were lit up last evening, and the engine tested for economy and indicated by Mr. Clarke, while running the 5 dynamos & 1 field. Economy test. Average area of friction diagram. Back end .30 sq. in. Front end .57 sq. in. Indicated H.P. 12.46 — Average of diagram with lamps on. Back end 1.45 sq. in. Front end 1.525 sq. in. Indicated H.P. 41.55 — H.P. due to 183 lamps 29.09 — or 6.3 lamps per H.P. The amount of water per hour by indicator was 1429.91 lbs or 34.4 lbs per H.P. per hour. Mr. Clarke says that the amount of steam used by the engine should have given 7.3 lamps per horse power, otherwise that a good engine should have given the same results with 30 lbs of steam per hour, per H.P.

Visitors to last nights illumination, Mr Biederman and some friends —

Coal. For the present the pea or dust coal has been dispensed with and large coal is in use under the boilers to day.

Small elec. engine. taken up stairs in the Laboratory to day but again "bugged" up and took all the afternoon to get it to run, Mr. Edison finally directed the connections and again got it to working.

"Layout" Visitors Aldermen — In the evening, by invitation the Aldermen of New York City were here to see the working of the lamp and system and to partake of both solid and fluid refreshments. The room of Laboratory was illuminated with 37 lamp and presented a fine appearance. In all about ~~225~~ 239 lamps were illuminated. The boys had their racket at Davis's. Part of whom celebrated at their own expense.

Papers. "Sun" World. Herald. Truth and Tribune give fair and favorable reports of the display and visiting here last night. Also dispatches that the suit in England of the government vs Telephone Companies was decided against the Telephones holding that they came under the telegraph act.

Carbonization. Acheson is making some experiments on carbons by request and direction of Mr. Edison, Soaking them ~~in~~ material (cardboard) in different products of petroleum and carbonizing, and repeating the process. No satisfactory results have yet been obtained.

Clamping by plating. Lawson has clamped some carbons to the leading wires by plating and is continuing the experiments. Also said to plate the ends of all carbons.

Generally, Suckling, [illegible] we did [illegible] went across including
to quit [illegible]

Motor test. The one horse power electric engine was again tried tonight but does not work satisfactory as regards the current and produces too much fall on the lamps of the line, giving a drop equal to the current of about six lamps. On this current, about equal to one horse power, it run 2630 Revolutions with 92 volts on the line. The governor is also unsatisfactory because of its noise and the effect on the lamps. Mr. Edison suggests to govern on the field by throwing in or cutting out coils and thus strengthen or weaken the field.

Fall on lamps. Thirty two lamps were in circuit and one measured in the photometer room gave 9½ candles. Twenty four were then turned off and the photometer lamp raised to 15 candles.

Visitors Briers & Waterhouse with arc lamp, and engineering mechanism for regulating.

Absent. Mr. Edison at N.Y. Clarke also absent & Batch.

Engine. As a compromise and with better results large coal is being mixed one half with the dust. Under the boilers and water supplied by team drawing from the creek.

Motor. Mr. Upton making some tests of the one horse power motor to determine if possible whether sufficient improvement can be made in the winding of armature or proportioning to prevent the irregularity it now produces on the lights. The armature was taken out to rewind with higher resistance than its present .6 ohms and Mr. Edison suggests it be wound for about two ohms.

American Union wires were to day connected with the Laboratory for telegraphic communication.

Lamp tests about thirty lamps were tested at the factory for the first testing with electric dynamometer and Photometer

Visitors Harlin of McNab & Harlin, with three friends.

Absent C. P. Mott returned after absence since Friday noon.

400 Lamp test. 400 lamps were burned on Friday evening, Christmas eve, and Economical test made of the Engine by Mr. Clarke, boilers forced to 90 lbs pressure engine to 75 Rev. gave 6.9 Lamps per horse power, but I believe this result is obtained after deducting the power consumed in friction of shafting etc.

Well On Friday morning some lumber etc. was delivered and preparations commenced for sinking a driven well at the Machine Shop. On Monday morning actual work in sinking was commenced.

Factory The second tier of pumps has been nearly completed but an accident causing the absence of Van Cleve put back the carbonizing and

~~So~~ sufficient Lamps have not been made to yet require the additional pumps.

Motor. The mounted one horse power Motor Armature was rewound two ohms resistance and the governor removed. A line of shafting put up in the Laboratory and Motor tried this morning. It ran very satisfactorily and had no very appreciable effect on the lamps burning in same circuit.

Carbonizing. Mr. Acheson in his experiments on carbonizing in connection with Products of Petroleum placed a mould while hot from the furnace in ~~which~~ thoroughly covered and protected from the air, the mould, although an old black one, ~~the~~ came out of the sand white and natural nickel color.

Papers "New York Herald" contains dispatch from Philada: that the Porter Allen engine is completed and ordered shipped to Menlo Park. Also that the Law Committee of the Board of Aldermen to whom was referred the application of the Edison Illuminating Co. for privileges of laying their wires in the Streets, had reported a resolution that that Co or other Elec Light Cos have the privilege by paying to the City 10 cts per foot for the Streets disturbed and after five years ~~pay the~~ three per cent of their gross receipts.

1/2 Lamps. 7 full lamps were put at 48c and 17 half lamps at same incandescence or 24 candles for a comparative test of their usefulness. The halves show much greater tenacity than the wholes. Although the latter give an average of 12 hrs 17 m. against 5 h 48 m the average of 100 tested at 12.80

 Dec. 29.

Absent. Mr. Clarke took train east 9.20 on return says all papers signed and bargain closed with Buckeye Engine Co for 100 horse power engine to run 250 Revolutions Mr. Edison also left for New York at 11.20 returned early evening.

Carbonizing. In view of the effects, discovered by Acheson, of excluding the air from the moulds while cooling, Mr. Batchelor sent to Laboratory and collected the ashes of the old furnaces, to use for burying the flasks at the factory.

Snow. Severe snow storm continued all day.

Thursday Dec. 30. 1880

Power. No power in the forenoon, changing the pulleys for the Logan's Lathe, water scarce and weather so exceedingly cold and windy that the men cannot stand it to draw.

Plating & Governor Sketches } Mr. Edison made a sketch of a governor for an electric engine operating directly on the shaft and effecting its purpose by moving a lever or other suitable device over resistance coils or boxes throwing them in or out as the case may require. Also one of Apparatus for plating carbons to the wires without use of clamps. being a vessel containing the plating solution in which one electrode is placed, the inner part containing the wires to which the carbon is temporarily attached is passed through a rubber cork which forms the bottom

of the vessel or reservoir, the other or opposite electrode is connected to the wires extending out of the inner tube which extend together with the tube through the cask sufficiently low to immerse the ends of the carbons say 1/8 of an inch. As the plating progresses the wires and carbon are united and held by the deposit. Sketches dated by him Decr 24 and taken to Motts table for Patent Office drawings.

City of Rome. Mr. Clarke commenced the drawing work on the details of the Dynamo & engine for the Steamer City of Rome of the Inman line, now building.

Chandelier the second twelve half lamp chandelier was completed and taken to Mr. Edison's house

Watch. C. P. Mott remained up all night to discover if possible the person who has been on several occasions removing the plugs of the American Union wires from their propper position in the switch board. Not disturbed. About six in the morning the steam pipes thawed out in the Labratory and soon filled the chemical room with steam.

Present. Mr. Edison received to day from McLaughlin, Powers & another friend, a Present of a very hansome gold headed cane.

Smothered moulds. A mould at the Factory was buried in ashes while hot and allowed to remain all night. The carbons tested to day were found very high resistance from 350 to 700 ohms. Mr. Batchelor had sheet iron hoods or encasing boxes made in which to place the moulds ~~in~~ Petroleum gum or other gaseous material having been first placed therein and by

the heat of the moned gas generated to act upon the moned in place of air.

Factory Management) Notices were today posted at the factory to the effect that on and after Jany 1, 81 Mr Upton would take charge and management of that place

Sample Bamboo. Bradley cut some strips from Bamboo which he believed to be samples sent by man sent to Japan and China. it is exceedingly fine and unusually free of pith, came out very fine from the carbonizing flask.

Absent. Mr Clarke gone to Philadelphia. Visited by reporters etc.

1880 The closing month of December gave two new moons and eclipse on the Sun this morning. very cold weather and about 400 lamps in readiness for

Lighting New Years night.

Carbonization Acheson placed sticks of ordinary charcoal in tube in the opposite end of which was placed ~~Kerosene~~ Petroleum pitch. the end containing the carbon was placed in the furnace and gas flame burned under the outside end to make gas from the pitch which passed through the tube and ~~escaped~~ through a small hole in carbon end. One treatment gave a steel like metallic look and ring to the sticks, He also observed that if the gas was shut off from the carbons while still very hot the deposit was more metallic or that by allowing the gas to come in contact with the carbon after partially cooling the deposit was dull black. thus solving the problem of the cause why in previous trials the same results were not always obtained

 Jany 1-81.

Holiday. No work in shop to day and but one or two at work in Laboratory finishing preparations for burning to-night about 400 lamps.

Illumination & Economic test } In the evening 408 lamps were burned and a number of visitors were here to see the display. Mr. Clarke made a test of the engine while running for the lamps and developing 82.3 horse power and got ~~exceedingly~~ perfect diagrams. Boiler pressure 110 lbs. Revs 75. Total H.P. 82.3 less frictional diagram left net of 61.95 H.P. or on 408 lamps gave 6.59 per H.P. less fried gave net 7.88 per h.P. or 22.58 pounds steam per H.P. per hour. Proving the Brown engine first class for economy etc.

Papers, World publishes report of visitors yesterday, mean untruthful report headed Edison Melancholy-

Monday Jany 3. 81

Driving belt. The large main driving belt was respliced and tightened yesterday while the engine was idle.

Well Men have gone down 65 feet with the well and to day swung their machine around and belted it to their own engine. The belt not holding well on the pulleys of inside shafting were at first used.

One half loops. A lamp was sent up from the factory with two one half carbons connected therein in series and facing at right angles to each other. Also one with one full loop & a loop or rather one half of a full loop the half being a broken full one and unconnected at the upper end. Also one with condenser of mica & foil. All for experiments.

Visitors Mr. Green. Worcester Mass. and friend to talk and get what information he could on getting the light introduced in his dwelling house. Also Hopkins of Scientific American with artist taking sketches, Also Biederman in the evening.

Lead cable. One box with coil of Lead insulated wire. three wires each in small lead piping these in turn enclosed in one Large one about 5/8 inches was received at the Laboratory.

Lead Insulation Francis has been testing the lead encased wires on telephone and sounder and finds some induction Especially noticeable with the sounder.

New Engineer. New man formerly with Maxim and U. S. Elec Light Company is now here assistant with Swanson in running the engine.

Porter Allen Engine. The Porter engine was received to day not yet unpacked.

Visitors Mr. Wilber here a few minutes in the morning. Also Goddard and party of friends and Hopkins with friends in the evening.

Economic test. Mr. Clarke indicated the engine again ~~Last &~~ to night on Nine dynamos & one field supplying 464 Lamps. Engine 78 Revs. with as high as 115 lbs steam pressure.

Platinized carbon. Lawson boiled some carbon loops in Aqueous solution of Platinum chloride, believing that when heated in vacuum on pumps the chlorine will be driven off, leaving the platinum in the pores of the carbon in a finely divided state - But what will the platinum do when the loop is heated to high incandescence? - trial will show.

Govenor, a governor for throwing in and out resistance, according to the speed was finished and put on the small Elec. engine up stairs - no connections yet made with resistance boxes.

Clamping: Dr Moses melted a pair of silver clamps in a globule on the end of the platinum wires and while hot inserted the ends of the carbon loop the silver cooled and firmly held the carbon with very little injury to the carbon by oxidization, he thinks that by turning a cooling gas on the globule immediately on inserting the loop all injury could be prevented.

Factory additions. Masons are working on the foundations and carpenters on the frames &c for addition to the new building for carbonizing also addition to front of old building for store house &c for glass.

Sockets John Ott finished a pair of sockets for B. lamps with key at the bottom acting on a spring which forms the contact same style and principle of one made by Mott Nov 26. except in the Mott socket the

acted and formed the connection direct, without intermediate spring.

Governor. Francis connected four small german silver resistance boxes with the plates on which the spring of the governor contacts in such manner that when the current is first switched on, the resistance is all in and as the speed increases the governor gradually cuts out the resistance until all is out, the object undoubtedly being to produce as slight effect as possible on the lamps when the motor is first put on.

Absent Mr. Edison in New York all afternoon returning in the evening.

Special Dynamo. Logan is winding a magnet for a special dynamo machine for lighting some establishment in New York, using much finer wire and about forty five pounds of it, the machine being intended to make its own field, hence the higher resistance of the coils around magnets.

Illumination. Lit about 500 lamps at dark and burned till 8 o'clock at deflection of 173 on Galvanometer scale, being about five degrees higher than the usual burning. No tests were made of the engine, but the boilers furnished steam for the Brown, West, blower, and well digger engines

Visitors Morgan and others of the firm of Drexel Morgan & Co. a number of stock holders, and Cummings of the "Sun."

 Jany 6-81–

Carbonization- Acheson is getting gen'l uniform and good results in Metallic appearing carbons in tubes with gas from Petroleum products therein, at ~~low heat that is~~ high red heat, and is gradually loosing confidence in his theory that the dull black is due to low heat of carbons in the gas- see Jany 1.

Lamp experiments Mr. Edison wrote out some 9 or 10 experiments for Lawson to try in Lamps at Factory. Mostly the introduction of Phosphorine, Sodium etc. in the globe, to be acted on by the heat on pumps or in use. list copied in Book No. 168 pages 9 etc.

Friday Jany. 7. 81

Papers. The "Sun" has a short article on the illumination here last evening, by "800" Lamps from nine machines and that the "Phelps" Engine & dynamo is expected to furnish current for 1000 to 1200 Lamps.

Platinized carbons. The carbons Platinized by Lawson were put in Lamps and exhausted, the resistance cold was from 520 ohms the lowest to 820 the highest but on heating in the vacuum the resistance was evidently very much lower than the regulars, as shown by the higher incandescence of them in same circuit with the regulars.

Economic test. Outside 383 Lamps, inside 107 total 490 Lamps were burned all night and Mr. Clarke took diagram cards from engine and had all coal carefully weighed. test not satisfactory in consequence of two additional engines taking steam part of the time and steam turned on in Laboratory, during the test

 Jany 7. 81

Armature. Mr. Edison gave Mott a sketch from which to make Patent Office drawings, of an armature; designed for powerful machines in which the bars are used (same as the Porter Allen dynamo) but the commutator is formed of discs arranged to connect the bars to the commutator blocks it is intended to be more easily and cheaply constructed than the one now being made for Porter Allen Dynamo but carrying out the same principles and efficiency.

Saturday Jany 8. 81.

Experimental Lamps. Lamps with variously treated carbons and of different mechanical arrangements were completed and sent up from the Factory. they were tested by Francis Jehl are not today arranged for trial of stability. One lamp with platinum wire coiled around and part of (say one fourth) the way up one side of loop. 2 lamps with platinum loops from same conductors, parallel with the carbon. 2 ~~loose~~ half length carbons at right angles in series in one globe, one with a carbon broken in two clamped separately and standing parallel with one side of loop. One with condensers tested at 48c and 4. ½ Lamps. carbons treated with petroleum, one with platinized loop and four treated with carbolic acid tested at 24c Book No. 186 page 1 etc.

Jany 8. 81

Lamp test } Twenty-seven, 7 of which were Bach ba regular Lamps, were
Regulars } started at forty eight candles this morning to be timed and their life at that incandescence determined during the day nearly 50% if failed

Book No 166. page 71 &c.

Illumination In the early evening the lamps were started, but the large pulley on the counter shaft slipped and the engine was stopped to the disappointment of a number of sleighing parties who had driven here in pursuance of a false voluntary notice in the Tribune that a public exhibition was given every night and the public welcome to visit here.

Visitors Welles & Dyer, also reporter of the Philada. Ledger.

Absent Mr Batchelor, also a large sleighing party in the evening.

Work general of past week. Well digging continued and not much water at 100 ft. Porter Engine received. Mr. Upton's first week at the factory. Engine with coal test made by Mr Clarke. Acheson carbonizing

Menlo Park Notebook #119 [N-80-09-27]

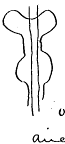
This notebook covers the period September-October 1880. Most of the entries are by Francis Jehl. There are also occasional entries by Francis Upton. Many of the entries are initialed by Edison. The book contains notes and tables of tests relating to the first lot of lamps (numbers 1-100), which was sent from the lamp factory to the laboratory for testing. There is also a copy of a note from Batchelor to Upton concerning these lamps and a list, prepared later, of lamps sent. The label on the front cover is marked "Factory," "Jehl," "Oct 1880," and "Lot 1 Lamps." There is an index on the inside front cover. The book contains 284 numbered pages.

Blank pages not filmed: 272-275, 280-281.

Index.

Sept 27 1880

Note from Mr Bachelor to Mr Upton) I sent 17 lamps with nickel clamps of this pattern



The wires put through the glass which is made concave at the point where the wires come out. I now send more and that makes

17 with nickel
21 "
38

Also 9 with platinum clamps of which 6 bad viz — 1 Blue light
3 split in clamps
1 badly bent
1 high resistance

All these lamps are made from the fishing rod Bamboo cut previous to September 25th and are unpickled; so that we consider them poor and call them ((Fibres No 1))

Sig
Bachelor

20 cell = 32

~~EMF 20~~

EMF 7 257

20) 3765 (188
176
160
165

E.M.F. 250 - 250

Res. 37650
200

Cau. 48.

Battery = 32 - 32

TAE

Sept 27 1880

2.1673
2.1673
1.6164
7.7258

3.7068

5090

140:153::159

2014
1847
8539

2400

174
159

+15

8153

140:153::159:a

$\frac{1}{a} = \frac{153 \times 159}{140}$

153
140
140

153 × 159

140 2.1461
2.1461
1.6464
159 7.7946

3.7372

5460

Exp?	250 d R £ 250	~~129~~
Res	37650 ÷ 200	188 R
Candle	48	21 Res
Battery	20 cells = 32.-32	

1.8) 7500 (139

70

54

160

20) 37650 (188

20

176

160

165

2.1553
2.1553
1.6464
7.7645
3.7215   5260

No 2

Cur7 242 - 243
Bat 32 - 32
Res 31400 + 3000 / 200
Caw 48

1430
~~7346~~
172 Res
2.5 oh
(34400
17200

31400
3000
20) 34400 (172
20
144
140
4

1.8) 2420 (134
18
62
54
80

2.1818
2.1818
1.6464
7.7258

3.7358 5440 ft. lbs.

No 3

Elect 259 – 259~~143~~ 152

Res 37650 / 200 188 Res
188.

Bat 32 – 32 14 ohms

Cwls 48

18) 2590 (143
18
79
72
70

20) 3765 (188
20
176
160
165
160

2.1367
2.1367
1.6464
7.8125
3.7323

5400

4

Emf 234 — 234
Res $\frac{25150 + 5700}{2000}$
Bat 32 - 32
Cell 48

1370
154 ohms
23 20 ohms
57
308
154

1.8)234(130 Kai
18
54

25150
5700
20)30850(154
20
108
100
85

17) 238 (14

68

2.1461
2.1461
1.4464
7.7773
3.7159 5200

~~144~~

140 164 167 167

164
668

7398 19
T40
1260

167

8153
1399
7799
7451
2549

180
166
+14

138 2.1399
2.1399
1.6464
166 7.7799
3.7061

5080

No 5

Aut 2.38 — 238
Bat 32 — 32
140 ~~1320~~
167 Res
28 obeys
Res ~~27650~~ 31400 + 2000
2000
Cand 48

(334
167

18) 2380 (132
18
58
54
40

31400
2000
20) 33400 (167
20
134
120
140

2.1875
2.1875
1.6464
7.7100
3.7314 5380

Elect 263 – 265 – 154 ~~146~~ V. 195 ohms
Res $\frac{37650 + 1500}{200}$ 120 ohm
Bat 32 — 32
Curr 48
Blume

.376
15
391
195

TAG

1.8) 2630 (146
18
83
72
110
108

37650
1500
20) 39150 (195
20
191
180
115

2.1987
2.1987
1.6464
7.7258

3.7696

5880.

Elk	270 — 270	188 Reo
Res	$\frac{37650 + 100}{200}$	1580
Bat	32 — 32	7 ohms
Card	48	377
		188

37650
  100

20) 3775.0 (188
   20
   177
   160
   175

1.8) 1700 (150
   18
   90

TAG

2·1931
2·1931
1·6464
~~7.7447~~
3·777[3]

5990

Elm	264 — 268	180 ohms
Res	$\frac{31400 + 4700}{200}$	v 156 ohms
		150 ohms
Cans	48	
Batt	33 — 32	

314
47
361
180

31400
4700
20)36100 (180
20
161
160
10

18)2640 (146
18
84
72
120
108
12

TKG

2.1931
2.1931
1.6464
7.7399
3.7725   5910

Ent 266 - 264
Res $\frac{31400 + 5000}{200}$
Cam 48
Bat 32 - 32

1560
~~1470~~
182 ohms

9 ohms

(364
182

18) 2660 (147
1894
86
72
140

3
18/4

31400
5000
20) 36400 (182
...
164
...

2.1553
2.1553
1.6464
7.7496
3.7066 5090 ftths.

no 10

Art	243 — 243		~~1435~~ ~~1355~~
Res	$\frac{31400 + 4200}{200}$		178 Res
Bat	32 — 32		26 olns
Cavl	48		

314
42
356
178

81
2
160

31400
4200
200)35600(178
200
1560
1400
1600
1600

Ok?

2.1553
2.1553
1.6464
7.7520

3.7090 5120

No 11

Cunt ~~256~~ ~~254~~ 243 – 243
1430
~~1350~~
177 Bo
25 ohm

Bo $\frac{31400 + 4000}{200}$

~~Cal~~

Cand 48

Bat 32 – 32

$\frac{354}{177}$

31400
4000
20) 35400 (177

18) 2430 (135 1540 140

The ?

2.1931
2.1931
1.6464
7.6799
3.6925

4920

no 12

EMF	268 - 266	1560 ~~1470~~ 209 Res
R	$\frac{37650 + 4200}{200}$	10 ohms
Bat	32 - 32.5	
Cond	4.8	376 42 418 209

18)2660(147
18
86
72
140

18
8
144

18
7

TCE

266
88
176

37650
4200
20)41850(209
185
180

2.1492
2.1492
1.6464
7.7375
3.6823   4910

CMF ~~252~~ 242 – 240
Res 31400 + 5200 / 200   1480
183 Res
Cand 48   29 Res
Bu 32 – 32

314
52
366
183

1,8) 2449 (133
1540
64
54
70
54
16

Tal
31400
5200
20) 36600 (183
20
166
166
60
60

2.1732
2.1732
116464
7.7100
3.7028   5040

No 14

E M7   269 - 2690   1580
Rio   37650 + 1500   195 Res
Nat   31 - 33 200   7 others
Card   48

269
269
538
149

3)138
1

3)138

376
15
391
195

149
1.8)2690   (149
28
89
72
170
162
7

37650
5000
20)38650 (195
180
105

2.1644
2.1644
1.6464
7.7520
3.7272

5340

No ~~213~~ /5 — 1460

EMF 250 - 250 ~~1350~~ 177 ohms

Res $\frac{31400 + 4000}{2000}$ ~~33~~ R 21

Bat 31, 33

Case 48

354 / .177

1.8) 2500 (138
18
70
54
160 7

31400
4000
20) 35400 (177
20
154
140
14

KWG

1.08
20
2.160
64

$\frac{400}{64} \times 20 \times 1.68$

1.3345
1.8062
T.5283
2.6021
2.1364
2.1304
1.6464
7.7520
3.6592
.5145
.8593

2.1347
2.1347
1.6464
7.7721
3.6919

135

31400
4000
35400

4590

4970 ft lbs

7.2 per H.P.

32) 200
142
6080 (6.2

254
6.2
508
1524
157.48

314
40
2 | 354
177

33
32
3 | 65

200
200
3 | 400
133

Emf	235 – 235	4900 ft lbs	1370 169 Res
Res	~~37600~~ – 314.00 + 2500		
Bat	32 – 32	200	
Cand	48	little	33 ~~44~~ ohms Bent

Emf	200 – 200
Bat	33 – 32
Res	31400 + 4000 / 2000
Cand	16

354
177

End of the first Cod of Lamps

177 157
157
1099
785
157
27649
4413
23947
98596
98596
10919507

3
177) 10919507 (6169
10624
295
177
1225
1062
1630

2.1523
2.1523
1.6464
7.7471

3.6981   4994.0

218
218
3 | 436
145

31400
4500
200 | 35900
179

No. 4.

962 2.2095
2.2095
1.6444
202 7.6946
3.7600

5760

8153
2095
6946
7194
2806

191.
1

No 17

Cand	16
Exit	~~218~~ – 218
Res	$\frac{37650 + 3000}{200}$
Batt	32 – 32
Clt	2~~42~~ + 247
Res	$\frac{31400 + 4500}{200}$ 142 ~~1340~~ 179 Res
Guid	48
Bat	32 – 32 27 ~~40~~ ohms

1.8) 2420 (134
18
62
54
80

31400
4500
20) 35900 (179
20
159
140
190
180

3 | 424
141

212
212
3 | 424
142

37650
1000
1420) 36650 (193

186
180
3 | 212
70
140

1.18
32

236
37.76

37650 4440 ft. lbs
3300

21.6) 38.8 (1.8
1640
1528

2.16
1.8
36.72

2.16
1.8
38.88

243
245
3 | 488
162

EM7	212 - 212	~~1350~~ 1900 ohms
Res	37650 + 1000	
Bat	32. - 2000 / 32	
Cond	16	
		1430
EM7	243 - 245	~~1350~~ 204 ohms
Res	37650 + 3300	
Bat	32 - 2000 / 32	~~43~~ ohms 29
Cond	48	

Up to this camp they were all tested with the old battery the 32 def is to be multiplied by 1.18

32

2.1644
2.1644
1.6464
7.7471
3.7223

5280

19 Sept 30th

E.M.F.	~~205 – 205~~ 185 – 185	
Res	37650 + ~~1500~~ / 200	188 Res
Bat	32 – 33	1230
C	16	~~46~~ ohms
EMF	219 – 219	
Res	31400 + 4500 / 200	6½
Bat	32 – 32	122
Curr	48	1460
		179 R
	20) 3765 0 (188	22 ohms

2000
176
160
165
160

2.1875
2.1875
7.6968
1.6464
3.7182   5230

2.1239
2.1239

200
198
2 | 398
199

37650
4900
2 | 42550 | 212
40
255
200
55
40

Em	232 - 232	201 Res
Res	$\frac{37650 + 2700}{200}$	154 "
		13 Res
Can	48	
Bat	32 - 33	T.E.E.
Aut	200 - 198	200 / 198 / 398 / 132
Res	$\frac{37650 + 4900}{200}$	
©	16	376.5 / 49 / 2 | 425.5 / 212
Bat	33 - 32	

Stop for to tend some links.

37650
2700
40350

37650
2700
200 | 40350 | 201

3 | 232
77
154

3 | 464
154

2167	260 — tohigh
Bat	32 — 32
Res	$\frac{37600 + 12000 + x}{200}$
Cam	16 ~~4~~ Cal

This is all I could get on it. On one of the clamps there was that peculiar phosphor escence.

$$\begin{array}{r} 260 \\ 3\overline{)520} \\ 173 \end{array} \quad 2 \quad v$$

2.1461
2.1461
1.6464
7.7747
3.7133   5170

210
213
3 |423
141

31400 3
2300
2000 |33700
168

179
182
3 |361
120

C	48
Res	$\frac{31400 + 2300}{2000}$
E. Wt	210 — 213
Bat	32 — 33
	Blue
C	16
E77	179 — 182
Res	$\frac{31400 + 4600}{2000}$
Bat	31 — 33

1400
168 Res

28 R

31400
2300
20 |33700 (168
20
137
120
170
160

3 |212
72
140

2.1461
2.1461
1.1646
7.7645

3.7031 5050

E.7M	210 — 214	140 0 172 Res
Res	$\frac{31400 + 3100}{200}$	
Bat	30.5, 33	29 Res
@	48	

EM7	180 —
Res	$\frac{31400 + 4500}{200}$
Bat	30.5 — 33
@	16

31400
3100
20 | 34500 (172 Res
1,45

3 | 212
70
2
140

2.2041
2.2041
1.16464
7.6216
3.6762

4750 ft. lbs

C 48 1600
CMF 240 243 239 Res
Res 5(Ohms)
$\frac{37650 + 10200}{200}$
Bat 30.5. 33 Blue

CMF 200 — ? ok?
Res $\frac{37650 + 12000}{200}$
Bat
C 16

80
2
160

37650
10200
20) 47850 (239
68
185

2,1523
2.1523
1,6464
7.8013
3.7523

5650

182
183
3 | 365
122

314
45
5 | 359
179 - 180

EMF	215 - 214 142 V 158 Res
Res	$\frac{31400 + 300}{200}$
Bat	30 - 33 24 Res
C	48
	Cute [illegible]
Res	$\frac{31400 + 4500}{200}$ 314 45 2 | 359 179.5
C	1.6
Curt	182 - 183 182 183 3 | 365 122 Volts
Bat	30 - 33

31400
300
20 | 31700 (158.
20
117
160

71
2
142

2.1875
2.1875
116464
7.7190
3.7404

37650
6200
2000 | 43850 | 21.9

198
198
3 | 396
132

C	48
R	$\frac{37650 + 700}{2000}$
EM7	232 — 232
Bat	33 — 30
	Blue and mercury in glob

154.0
191 Res
5500 ft. lbs.
12 ohms

KWG

C	16
R	$\frac{37650 + 6200}{2000}$
E.M7	198 — 198
Ba	34 — 30

37650
6200
43850
21.925

198
198
3 | 396
132

37650
700
20) 38350 (191.
20
183
180
35

3 | 232
77
154

27

had a very bad spat and gave away at about one Claudee,

[illegible]

A very weak spot on the top of the loop. gave away ~~[illegible]~~ some Hg was in the glob

TRG

2.1523
2.1523
.16464
7.7747

3.7257

5320

C	48
Res	$\frac{3.1400 + 2300}{200}$
E.M.F.	212 — 213
Bat	33 — 32

1420
168 R

26 ohms

E.M.F.	180 — 180
Res	$\frac{31400 + 4000}{200}$
C	16
Bat	305 — 33

314
40
354
177

180
180
360
120

31400
2300
20) 33700 (168
20
137
120
170

$7\frac{1}{2}$
14^2

2.1523
2.1523
1.6464
7.8013

3.7523   5658

Rs	31400 + 200	142 v
E.M.F.	213 200 212	158 Rs
C	48	24 ohms
Bat	31 – 32	
	Rlue at one of the clamps	
C	16	
E.M.F.	~~190~~ 190 – 190	
Rs	31400 + 1700	
Bat	33 200	

190
190
(380
1266

310
17
(331
165

31400
200
20) 31600 (158

3) 212
7½
142

2.1875
2,1875
1,6464
7.6757
3.6971 4980

232
234
3 | 466
1553

3765
690
20 | 4455 228
40
45
45

Res	$\frac{37650 + 4700}{200}$	1540 211 R
EMF	232 — 234	
Bat	32 - 30,5	13 ohms
C	48 Blue in clamps	
C	16 TKE	
Res	$\frac{37650 + 6900}{200}$	376. 69 445 222
Bat	32 — 32	
EMF	215 - 215	215 215 430 143

37650
4700
20) 42350 (211 R
40
23
3(233
77
154

2.2041
2.2041
1.6464
7.7077
3.7623

5780 ft. lbs

32

Res	$\frac{37650 + 1600}{200}$	1600
EMF	240 - 241	196 Res
C	48	4 ohms
Bat	32 - 33 Blue in Clamp	
Res	$\frac{37650 + 3500}{200}$	376. 35 411 205
EMF	210 - 212	210 212 422 141
C	16	
Bat	32 - 33 Blue in Clamp	

37650
1600
20) 39250 (196.
20
192
180
125
120

80
2
160

2.2095
2.2095
1.6464
7.6326
3.6980 4990

37650
1190
2 | 38840
19420

201
206
3 | 407
135 136

Rio	$\frac{37650 + 9000}{200}$	233 Rio
C	48	162 C
E.M.+	240 — 247	2 (change)
C	16	376 / 119 / 3884 / 1942
E.M.+	$\frac{37650 + 11900}{200}$	
E.M.+	201 — 206	206 / 201 / 407 / 136

37650
9000
20) 46650 (233
40
66
60

49
47
2) 84
43

3) 243
81
162

2.1703
2.1703
1.6464
7.7235
3.7105

5130

189
190
$3\,|\,979$
126

37650
1700
$200\,|\,39350$ 196
193
180
135
120
15

Res	$\frac{37650 + 300}{200}$	1480 / 189 Res
Emf	220 — 224	20 ohms
C	48	
C	16	
Res	$\frac{37650 + 1700}{200}$	
Emf	189 — 190	

37650
300
$20\,)\,37950\,(189.$
20
179
160
195
180
5

$3\,)\,222$
74
148

2.2148
2.2148
.16464
7.6517
3.7277

5340

232
239
471
157

37650
6800
44450
232

Res	$\frac{37650 + 7000}{200}$	164 C 223 Res
C	27	Nothing
E. Mf	245 — 251 Blue at cloudes Hg in globe	
Em.f	232 — 239	
Res	$\frac{37650 + 8800}{200}$	
C	16	

37650
7000
20) 44650 (223
40
46
40
65

45
51
2 96
48

3 (248
82
2
164

2.1584
2.1584
11646Y
7.7375

3.7007   5020

aten
143 2.1553
2.1553
16464
182 7.7399
3.6969
4970

8153
1553
7399

7105

2895

195
182

713

Res	$\frac{314000 + 53000}{2000}$ 0144 Res 183
Emt	213 – 217
©	48 Blue in glob 32 Res
Res	$\frac{314000 + 70000}{2000}$
Emt	172 – 179 KP9
©	16

314000
53000

367000 (183 Res

188

70

213
217

2)430
3)215
72
2
144

3(.224
714
148

31400
5700
20)37400(185
186
110

2.1703
2.1703
1.6464
7.7328
7.7198

5250 H.W.

37

Res	$\frac{31400 + 5700}{2000}$ 1480 185 Res
C	48
EMF	222 - 226 20 ohms ~~Alter~~ Blue at the clamp
Emf	193 - 195 H.W.
Res	$\frac{37650 + 6000}{2000}$
C	16

31400
4000
200) 35400
177

31400
5100
200) 36500
182

2.1072
2.1072
1.6464
7.7520
3.6128 4100

2.1139
2.1139
1.6464
7.7520
6262 4230

38

Res	$\frac{31400 + 4000}{2000} = 177$ ohms
Emf	193 – 198
C	48 ~~48 ohms~~ 49 ohms
Emf	182 – 179
Res	$\frac{31400 + 5100}{200} = 182$ ohms
C	1.6 9.4

182) 919 (5.4
3505) 33000 (9.4
182) 637920.0 (3505
9.4

31400
3000
200) 34400 (172

31400
3900
200) 35300 (176

227
231
2) 458
3) 229
76
152
152
304
760
152
23104
443
69312
92416
92416
172) 1023507.2 (5950.
860
1635
1548
870
860

5950) 33000 (5.5
29750
3250

3) 228
76
172
9
76
1548

595 2
2380 3
595 2
2975 4

Res	$\frac{31400 + 3000}{200} = 172$ ohms
	17
Elect	227 — 231 5.5 per HP
C	48 1520
	TAG 172 ohms
	Blue in globe and Hg in also 13 ohms
Res	$\frac{31400 + 3400}{200} = 176$ ohms
C	16
E.M.F	203 — 207 Blue at clump.
Bat	31 — 33

136
136
816
408
136
18496
44.3
55488

3205
68
136

31400
1300
20) 32700 (163
2
3) 203
67
134

2.1271
2.1271
1.6464
7.7877
3.6883   4880

129   2 1106
2 1106
166   1.6464
7.8069
3.6745
4720

8153
1106
8069
7328
2672

185
156
+29

40 Oct. 1. 80

Res $\frac{31400 + 1300}{2000}$ 1340
163 Res
EMF 203 — 204
36 ohms
C 48   1149
Bat 325 – 325

C 116
Res $\frac{31400 + 2700}{2000}$
EMF 170 – 169

$$
\begin{array}{r}
37650 \\
4100 \\
\hline
20)\,41750 \;\; (208 \text{ Res}
\end{array}
$$

$$
\begin{array}{r}
3)\,224 \\
74 \\
\hline
148
\end{array}
$$

$$
\begin{array}{r}
2.1703 \\
2.1703 \\
1.6464 \\
7.6819 \\
\hline
3.6689 \quad 4660
\end{array}
$$

C	48 — 1480, 208 Res
Res	$\frac{37650 + 4100}{200}$
E. M.T	224 – 223 — 22 Res
	Blue
Res	$\frac{37650 + 6700}{200}$
C	16
E. M.T.	194 – 193

3 | 223
74
148

37650
800
20) 38450 (192
20
184
180
4

2.1614
2.1614
1.6464
7.7167
3.6859

4850

42

Res	$\frac{37650 + 800}{200}$	1480 192 Res
Ent	223 – 222	20 Res
C	48	
Ent	190 – 189	
Res	$\frac{37650 + 2900}{200}$	
C	16	

3/ 209
69
1380

31400
2900
20)3430 (171
20
143
140
0

2.1399
2.1399
1.6464
7.7678
3.6932   4930

150 2.1761
2.1761
1.6464
7.7496
178 3.7482

5600

8153
1761
.7496
7410
2590

179
~~178~~

+1

43

Hg in glob   1380 171 Res

EMF 209 — 209   32 Res

R   31400 + 29000 / 200

C   48

C   16

EMF   150 - 179

R   31400 + 4700 / 2000

3) 234
78
2
156

37650
2900
70) 40550 (202
5

2.1931
2.1931
1.6464
7.6946
3.7272   5340

44

C	48	Res 202
		v 156
EM	7 234 – 235	9 ohms
Res	37650 + 2900	
	200 Blue at Clamps	
C	16	TAE
Res	37650 + 5800	
EM7	208 – 207	

37650
4900
20) 42550 (212 R
40
25
20
55

3 (213
71
144

2.1584
2.1584
1.6464
7.6737
3.6369   4320

160 2.2041
2.2041
1.6464
2.147.6696
3.7242

5300

8445
2041
6646
6896

3110

45

Res	$\frac{37650 + 4900}{1000}$
Elut	213 — 1243
C	48
C	16
Elut	182 — 183
R	$\frac{31400 + 7900}{200}$

Res 212
V 144
29 Res

71
142 ✓

177)88326.0 (5046
885
0826
708
1180

1180.

31400
4000
20)35400 (177

177
4
708

177
8
1416

177
6
1062

3)1180
60
120 ✓

160)837920 (3987
480
1577
1440
1392
1280
1120

16
5

16
9
144

16
9
144

46

EMF	213 – 212	1420
		177 R
Res	$\frac{31400 + 4000}{200}$	5046 fl lbs
		280 lbs
C	48	
C	16 .	120 ✓
		160 Res
Ewf	180 – 1874	3987 fl lbs
Res	$\frac{31400 + 6000}{200}$	

31400
6000
20)37400 (160 R
120
120

$3)\overline{211}$
70
140 V

171
1368

20)34200 (171
31400
2800
142
20

171)868880 (5077
855
1326
1197
1310

171
855 176

171
1368 5

3)180
60
2
120 V

180
4
720

20)3610 (180
31400
4700
161

180)637920 (3544
540
979
900
792
720
720

180
60

135 21303
21303
1.6664
166 7.7799
3.6869
4660

188
166
22

8153
1303
7799
7155
2745

Ro 31400 + 2800 / 200 Res 171
V 140
ftlbs 5077

C 48

E.M.F 211 − 212 TAE 29 R

C 16 120 V
180 R
E.M.F 180 − 179 3544 ftlbs
R 31400 + 4700 / 200

3/214
71
2
1420

163
6
984

163
9
67

31400
1200
20)32600(163
126
120
60

163)893240(5480
815
782
652
1306
1304
2

3/179
60
2
1200

168
4
672

168
176

168
9
1344
126

168)637920(3797
504
1339
1176
1632
1512
1200

48

Ent	214 – 213	1420 163 Res 5480 ftlbs
Res	$\dfrac{31400 + 1200}{200}$	
Cav	48 T&E	25 R
Ent	179 – 180	1200 Res 168 3797 ftlbs
C	16	
Res	$\dfrac{31400 + 2300}{200}$	

31400
2300
20)33700(168
23
137
120
170

3/261
87
2
174 V

37650
5000
20)42650 (2/3
40
26

213)1341230 (6296^65
1278

632
426
2042
1917
1460
1278

2.2405
2.2405
11.6464
7.6716
3.7996 6300

3/229
76
2
152 V) 1023500

232)1023500 (4411.
928
955
928
270
232
380

.49

EMT	260—262	174 V 213 Rs 6296 ft lbs
R.	$\frac{37650 + 5000}{2000}$	nothing
C	48 Blue at Clamp	
Rs	$\frac{37650 + 88000}{2000}$	
Emt	2 ~~28~~—230	~~1~~ K E
C	16	

152 V
232 R
4411 ft lbs

37650
8800
20)46450 (2324
40
64
60
45

3|237
79
158

37650
3700
20)4135 0(206
135

206)1105950(5457
1030
757
824
1172
1042
1420
1442

3|213
71
142 V

37650
5000
20)4265 0(213
26
65

213)893260(4193
852
412
213
1996
1917
790

EMF	237 – 238	158 V
R.	37650 + 3700	206 R
	2000	5457 ft lbs
		7 ohms
C	45 Blue at Clamp	
C	16 TKG	142 V
		213 Res
Emf	213 – 214	4193. ft lbs
Res	37650 + 5000	
	2000	

3)219
73
146

31400
46000
20)36000
180

944300

3)189
63
126

161
644

37650
800
20)38450 (192
20
122

192)703310 (436
644
593
463
1301
966
1350
1268
62

1288

51

EMF	219 — 220	146 / 180 Res / 5246 ft lbs
Res	31400 + 46000 / 200	
@	48 4A	22 R
EMF	189 — 190	126 / 192 Res
Res	37650 + 800 / 200	3663 ft lbs
@	16	

5 - 2

EM7	221 - 222
R	31400 + 3700
	2000
e	48

E. Mt	189 - 190
Res.	31400 + 5900
	2000
e	16

3)254
84
2
1680
192) 1251210

31400
7100
20)38500(192
20
185
180
50

3)230
77
2
1540

200)1050,962(5253
58
188
100
62
60
2

EmF	254 - 255 1680
	192 Res
Res	31400 + 7100 / 200 6516 ft lbs
C	48 Blue at clamp nothing
EMF	230 230 TK 1540
	200 Res
Res	31400 + 8700 / 200 5253 ft lbs
C	16 Blue at clamp.

31400
8700
20)40100
200

3/229 19
76
2
1520

1023500

31400
5000
20)36400(182
20
164
160
40

1.9
1

2.1818
2.1818
1.6464
7.7399
3.7499 5700

3/193
64
2
1280

192
768

10
6 10
192) 7 5 8 1 0 (37801
576
1498
1344
154
1536
5

37650
900
20)38550(192
20
185
180
55

193
7
1344

53 Th

E.M.F	229 — 230.5 — 1520 / 182 Res / 5623 ft lbs
Res	31400 + 5000 / 200 — 14 ohms
C	48
	Hg in this globe
C	16 — 1280 / 192 Res
Res	37650 + 900 / 200 — 3780 ft lbs
E.M.F	192—195

$\frac{3/285}{9}$

54 T.R.

C 33 to high Res

Bat $\frac{37650 + 120000 + x}{2000}$

E.M.F. 285 — 286

Em.f. 256 — 258

C 16

R ~~=3~~ $\frac{3765 + 120000 + x}{2000}$

37650
2000
20) 39650 (19
20
196
180
165
160

82
2
1640

198) 1191480

3/215
72
1440

37650
3600
20) 41250 (20
40
125
120

206) 916800 (4459
824
946
824
1220
1030
1900

55 [illegible]

C	48 0164 Res 198
E.M.T.	247 – 249 ftlbs 6017
R	$\frac{37650 + 2000}{200}$ nothing
EMT	214 – 216 1440 206 Res
R	$\frac{37650 + 3600}{200}$ 4459 ftlbs
C	16

80
2
160V

.37650
2600
20)40250
201

201)1134000

70
2
140V

37650
4800
20)43450(212
38
45

212)868200

56 Tel

E.M.F	240 — 242 Res 201 1600 ftlbs 6642
R	37650 + 2600 / 500 5 ohms
C	48 little Blue
E.M.F	~~24~~H.5 — 209 Res 212 V140 ftlbs 4095
R	37650 + 4800 / 200
C	16

3)246
82
164

20)37650 (176
188 ohms

188)1191480 (

200 R.

76
2
140

200)868280 (4341
80
68
60
82
80
28

Em 7	244 - 248
R	$\frac{37650}{200}$
C	48 Blue at clamps

164 v
Res 188
ohms 6348

nothing

Em 7	210 — 211
Res	$\frac{37650 + 2400}{200}$
C	16

37650
2400
20)40050 (2005
40
005

140 v
200 Res
ohms 4341

Hg in this globe
when Current was
put it went up, there
must have been a
very bad vacuum

5

$\frac{74}{1480}$

$$\begin{array}{r} 37650 \\ 1300 \\ 20)\overline{38950}(194 \\ 180 \\ \underline{100} \\ 95 \end{array}$$

970350

62^2 2202

67

$\frac{67}{1340}$

$$\begin{array}{r} 37650 \\ 3500 \\ 20)\overline{41150}(205 \end{array}$$

795450

59 Tele

	Hg in Therglobe 1480
e.m.f	222 – Res 194 fl lbs 5001
Res	$\frac{37650+1300}{200}$ 20 ohms
2	46 Blue at clamp
Emf	201 – 204 1340 Res 205
R	$\frac{37650 - 3500}{200}$ fl lbs 3880.
C	16

83
2
1660

37650
5200
20)42850(2142

214)1221170(5706
1070
1511
1498
1370

3)209
69
2
1380

37650
8200
20)45850(229

229)843650(3683
687
1566
1374
1925
1832
930

60 Oct 2 1850

E. Nit	249 — 250 v166 Res 214 ¶lbs 5706
Res	$\frac{37650 + 5200}{20}$ nothing
C	48 Blue in Clouds
E. Nit	208 — 210 v138 Rs 229 ¶lbs 3683
Res	37650 + 8200
C	16

2

78 179 31400
2 6 4400
156 1074 2435800 (179
20
158

179)1078090 (6022
1074
409
358
25 510
3(205 537
68
136 ✓

194 819370 180 2
4 180

191) 819370 (4289 $\frac{191}{573}$
764
553
382 10
31400 1717
6900 1528
20)3820 0 1890
191 1719

191 7
9
1528
191
9
1719

61 Tph

EMF	236 – 237	V 156 Res 179 ft lbs 6022
R	$\frac{31400 + 4400}{200}$	15R
C	48 Blue at Clamp	
C	16	V 136 Res 191 ft lbs 4289
EMF	204 – 206	
R	$\frac{31400 + 6900}{200}$ Blue at Clamp	

79
2
158 U

1105950

37650
4900
20) 42550 (2127
40
25
20
55

212) 1105950 (5216
1060
459
424
355
212
1430
1272

212
212
212
212
148
424
74
148 U

223) 870350 (4351
892
783
669
1145
1115
300

37650
7000
20) 44650 (2232 R
40
46
40
65
60
5

62

Oct 2 1880

Tasi

C	86 U.158 Res 212
Res	37650 + 4 ~~lbs~~ 5216 / 2000 8 ohms
EMF	239 - 240
Bat	33 — 31.5 Blue at clamp
EMF	222.5 - 226 148 U 223 Res 4351 lbs
Res	37650 + 7000 / 2000
C	16 Blue at clamp

72
2
142 ✓

181
05

181
9
1629

31400
4900
20)36300 (181

181
4
24

181)893260 (4935
724
1692
1629
636
543
930
905

179
182
2)361
180

189
56

37650
300
20)37950 (189

60
2
120 ✓

189
32

189)637920 (3375
567
709
567
1422
1323
990
945

Ttly ~~63~~ Same lamp as No 9

E.M.F.	212 — 212	✓ 142
Res	$\frac{31400 + 4900}{200}$	Res 181, ft 4935
		28 R
C	48	
E.M.F.	179 — 182	120 ✓
Res	37650 + 300	Res 189, ft lbs 3375
C	16	

3)225
75
2
150

37650
6500
20) 38250 (191
20
183
180
2

191
7
37 3

191
8
1528

191) 996750 (5218
955
417
382
355
191
1640
1528
12

62
2
124 ✓

205) 681160 (3322
615
661
615
466
410
560

37650
3500
20) 41150 (205
40
115

63 Tally

Em 7	224 — 226	150 w
Res	$\frac{37650 + 6000}{2000}$	Res 191 / ft 5218
e	48	17 R
Em 7	~~185~~ — 187	1240 / 205 Res / 3322 lbs
e	16	
Res	$\frac{37650 + 3500}{2000}$	

241 37650
9000

.80 × 2 = 160 20) 46650 (2332
40
66
60
1864
2097

233) 1134000 (4867
932
2020
1864
1568
1398
1700
1631

233 × 6 = 1398

3/225
75 × 2 = 150 ✓

37650
9700
20) 47350 (23
2436

236) 996750 (22
472
1247

236) 996750 (4223.
944
527
472
555
472
830
708

Res $\frac{37650 + 9000}{2000}$ v 160
Res 233
Ext. 240 – 242 ft lbs 4867
nothing.
C 24. Blue in Clamps

E Ext 224 — 226 v 150
Res 236
Res $\frac{37650 + 9700}{2000}$ ft lbs 4223.
C 16 Blue in clamps

3) 214
71
142

168
3
504

2 31400
22000
20) 33600 (168 R
20
136
120
160

162 3

168) 893260 (5317
840
532
504
286
168
1180
1176

168
7
1176

57
2
114 V

31400
4200
20) 35600 (178
20
156
140
160

160) 575720 (3
410
480
957

178) 575720 (3234.
534
417
356
612
534
780
712

534
178
12

2

Res	210 – 213	v 142 Res 168 ft 5317
Emt	$\frac{31400 + 2200}{200}$	25 R
@	48 Blue in glob	
Elist	172 – 172	v 114 R 178
Rest	$\frac{31400 + 4200}{200}$ ft lb	3234.
@	16	

198
1782

198R 37650
2000
20) 39650 (198
196
160
160

198) 1078090 (5448
990
880
792
869
792
770
1564

233
237
2)469
3)234
78
156 V

(211

70
140 V

37650
4900
20)42550
212 Res

R
212) 868200 |4095.
848
2028
1908
1200

64 Tag

C	48	V 156
Res	37650 + 2000 / 2000	Res 198 ft lbs 5448.
		10 R
E M7	232 — 237	
	Blue in Clamps	
Em7	210 - 212	V 140
C	16	Res 212 wedge at 16 C ft lbs 4095.
Re	37650 + 4900 / 200	Blue in Clamp

3) 228

76
2
152 ✓

37650
3800
20) 41450

207) 1023500 (4944
828
1955
1863
920
828

3) 188
63

126
4
504

126
8
1008

4920

126 ✓

126) 703310 (5561
630

733
630
1031
1008

37650
5800
23020 20) 43450
217

217) 703310 (3
434
2693

217) 703340 (3241
651
523
434
891
868

230

67 Tak

E. Mt	223 – 225 v 152
Res	$\frac{37650 + 3800}{200}$ of lbs Res 207 4944.
C	48 16 R
E. Mt	184 – 188 v 126
Res	$\frac{37650 + 5800}{200}$ ft lbs Res 217 3241.
C	16

22

$$\frac{81 \times 2}{162\ v}$$

$$\begin{array}{r} 37650 \\ 5800 \\ \hline 20)\ 43450 \\ 217 \end{array}$$

$$R\ 217)\ 1162610\ (5357$$

$$\begin{array}{r} 1085 \\ \hline 776 \\ 651 \\ \hline 1250 \\ 1085 \\ \hline 1650 \\ 1519 \end{array}$$

$$\frac{75 \times 2}{150\ v}$$

$$223)\ 996750\ (4469$$

$$\begin{array}{r} 892 \\ \hline 1047 \\ 892 \\ \hline 1555 \\ 1338 \\ \hline 2170 \\ 2007 \end{array}$$

68 TPG

Blue in Clampo

EM7	242 – 245 v 162 Res 217
C	24 ftlbs 5357
Res	$\frac{37650 + 5800}{200}$ 2 ohms
EM7	~~225~~ – 226 v 150 Res 223
Res	$\frac{37650 + 7000}{200}$ ftlbs 4469.
C	16 Blue in Clampo

$$\begin{array}{r} 37650 \\ 7000 \\ \hline 20)\ 44650 \\ 223\ R \end{array}$$

72
2
144

144
2
288

~~144) 918600 (6379~~
864
546
432
1140
1008
1320
1296

194
9
46

194
1
70

37650
1200
20) 38850 (194

194) 918600 (4735
776
1426
1358
680
582
980
970

61
2
122

208) 659360 (3121
624
353
208
456
416
400

69 Tag

Em7.	2215 − 216 v 144 Res 194
Res	$\frac{37650 + 1200}{200}$ 4735 ft lbs 26 R
C	48 Cubic ft lbs
Em7	183 − 184 v 122 Res 208
Res	$\frac{37650 + 4000}{200}$ ft. 3121
C	16

37650
4000
20) 41650 (208
40
165
160

224
228
2452
3)2226
75
150 √

37650
2600
20)40250(201
40

201)996750(4959
804
1927
1809
1185
1005
1800
1809

3)156
62
124 √

214)681468(3183.
642
381
214
1776
1712
640

70 TaE

E.M.T.	228 − 224 √150 Res 201
Res	$\frac{37650 + 2600}{200}$ lbs 4959.
C	48 18 R
	Blue in glob
Res	$\frac{37650 + 5200}{200}$
Emt	187 − 185
C	16

√124
Res 214
lbs 3183.

37650
5200
20)42850(214
40
28

72 169 3 31400 169
144 476 2500
200) 33900
169 olms

169) 918600 (5435
845
736
676
600
507
930
845

175 350

2400 60 120

175) 637920 (3645 175 1050 .3
525
1129
1050
792
700
920
875
45

71 Teh

Emf	215 – 216	v 144 Res 169
Res	31400 + 2500 ft lbs / 200	5435
C	48	23R
E.M.F.	180 – 182	v 120 Res 175 ohm
Res	31400 + 3700 / 200	3645 ft lbs
C	16	

31400
3700
200) 35100
175 Ohms

75
15.0

37650
2500
20)40150(200

200)996750(4983.
196
167
75

190
187
377
166
63
2
126

70

211)703310(3333.
703
633
701
633
680

72 Tilly

EN7	226 − 225 v 150 Res 200
Res	(37650 + 2500) / 200 ftlbs 4983. 18 R
C	48 Blue in flat
EN7	190 − 187
C	16
Res	(37650 + 4700) / 200

37650   v 126
4700   Res 211
20)42350(211 ftlbs 3333.
40
23
35

81/2 155
162 231
86

1162610
1155
00761
693
680

231)1162610 (5033
924
2386
2386

194 73 194
2 2 7
1364 146 58

194 194 01 194
8 3 2
32 702

194
7
1258

194)944300 (4867
776
1683
1552
1310
1164
1460
1258
102

81/2
162 73 Tak

Em7	243 1243 v 162 Res 231 ft fbs ~~4600~~ 5033
C	33
Res	$\frac{36650 + 9700}{200}$ nothing
Em7	219 - 21
Res	$\frac{37650 + 12000}{200}$
C	1.6

36650
9700
20)46350 (231
40
63
60

v 146
Res 194
ft 4867.

37650
12000
20)38850 (194
20
188
180
85

2
3)233
77
154

37650
2500
20) 40150 (200
40
15

200) 1050620 (5253
100
50
40
106
100
62
60
2

3)195
65
130

211) 748670 (3547.
633
1155
1055
1007
844
1630
1477

154 : 164 :: 200 : 200+4
200
154) 32800 (212
308
200
154
460
62

74 T&E

Emb 233 – 233 — V 154 Res 200 fills 5253.

Res $\frac{37650 + 2500}{200}$ — 12R

C 4.8 Blue in globule

Emb 195 – 196

Res $\frac{37650 + 4700}{200}$

C 16

37650
4700
20) 42350 (211 fills 3547.
28
35
20
150

V 130
Res 211

68
2
134

31400
1000
20) 32400 (
162

17956
44.8
52868
71824
71824

162) 795450.8 (4910.
648
1474
1458
165
162
30

172
172
3440
3172
57
114

169) 575720 (3
169

127

169) 575720 (3405.
507
687
676
1120
1014

169
1014

142 2.1523
2.1523
1.6464
164 7.7852
3.7362

8153
1523
7852
7528
2472

177
164
x13

5450

75 Pag

Em7 200 - 200 1340
Res 162.
Res 31400 + 1000 ftlbs 4910.
200
35 R

C 48 Blue in plat

7/14 172. - 174

Res 31400 + 2000

C 16 C 200

0114
31400
2500
Res 169
20) 33900 (ftlbs 3405.
169

134 : 164 :: 162 :: 162 + x
164
648
972
162

134) 26568 (197
134
1316
1206

197
162
35

226
228
2454
3|227
75
150
150
7500
150
22500
443
67500
93000
900000

199 3
4
995

1998
91

199
8 7
1592

37 | 191
63
2
126

199)99675000 (5008. ft lbs
99574
1200
1592
108

15876
443
47628
63504
63504

215)70339608 (32710
6453x
583
430
1530
1305
256

76

Em7	226 − 228 = 150 N T Res 199
Res	3200 + 36650 ft lbs 5008. 200
Cam	48 14R

3200
36650
20)39850 (199
38
198
180
185
180

Em7	190 − 192 120 U Res 215 ft lbs 3271
Res	5500 + 37650 200
C	16

37650
5500
20)43150 (2
40
35
115

150 : 164 :: 199 − 199 + x
164
796
1194
199
150)32636 (213
300
263
150
536
450

213
199
14

Oct 4 1880

Note from Mr Batchelor

Received from factory

Set 25 —	2	lamps	2.1644
28	47	"	2.1644
29	30	"	1.6464
30	30	"	7.7055
			3.6867
Oct 4	30	"	
	139 lamps		4800

all that could be counted up at this date was 134 lamps

J.U.

20 more came up.

1461.1164 :: 197 : 197+x

164
788
1182
197
146) 32308 (221
292
310
292
188

221
197
24

77 Oct 4 Tel

Bat 32 33 — 1460

EM 219 — 219 — 197 Res

Res 37650 + 1800 / 2000 — 24 R

C 48 Blue in glow

EM 187 — 187

Res 37650 + 4000 / 2000

C 16

73
146

37650
1000
30) 38650 (197
20
193
180
145

3)216
72
144

37650
600
20)38250
...
182
...
25

(191

2.1584
2.1584
116.464
71.7190
36822

4810

78

EM7 216 – 217
Res 37650 + 600
C 48

1440
191 Res
26 R

Little Blue

EM7 180 – 180
Res 37650 + 2300
200
C 16

144 1164 191 1914
164
764
1146
191
144)38324 (217
288
542
144
1080
1008
322

217
191
26

3)235
78
2
156

37650
4500
20)42150 (10
40
21
20

2.1931
2.1931
1.6464
7.6776
37.104

57.30

79 Tak

Ent	235 – 235 156 U. 210 Res
Res	$\frac{37650 + 4500}{200}$ 10 R
C	4.8
Ent	200 – 200
Res	$\frac{37650 + 6900}{200}$
C	16

156 : 164 :: 210 : 210+2

164
210
1640
328
156)34440 (220
312
324
312
120

220
210
10

$$\frac{72 \times 2}{1440}$$

$$20)\,36400\,(182$$
31400
5000
20
60
60
40

36

164 2.2148
182 2.2601
amp 144 7.8416
2.3165

207
182
25

2.1492
2.1492
1.16464
7.7399
3.6847

4840 [illegible]

Yo [illegible]

EM7	215–215	1440
Res	$\frac{31400+5000}{200}$	182 Res
C	48	18 ohms
EMF	176 – 176	
Res	$\frac{31400+7100}{200}$	
C	48	

144 : 164 :: 132 : 132+x
164
528
792
132
144) 21648 (150
144
724
720
48

144
132
76

150
132
18

73
.2
146 v

37650
2000
20 / 39550
30
196
180
16

2.1644
2.1644
1.6464
7.7053
3.6785

4770

81 Tag

EM7	218 — 218 146 v
Res	37650 + 2000 Res 198 / 2000 24 R
C	48
EM7	190 — 190
Res	37650 + 2900 / 200
C	16

146 : 164 :: 198 : : 198 + x
164
792
1188
198
146) 32472 (222
292
327
292
352
292

1.0 / 198 / 24

82
2
164

3

82 TAE TAE

Hg in Flux glob

Em-7	245 - 245 too high
Res	$\frac{37650 + 12000 + 4}{200}$
C	65.25 inches

Em-7	217 - 217
Res	$\frac{37650 + 12000 + 4}{200}$
C	16

3)250
83
2
166

3

83 128

Blue on clamp.
leaning on one side
to high

E.M7	250 - 250.
Res	$\frac{37650 + 12000 + x}{2000}$
C	23.5
Em7	240 - 240
Res	$\frac{37650 + 12000 + x}{2000}$
C	1.6

2

3 | 205

68

1360

314 0 0 0

20) 334 0 0 (167

134

120

140

2.1335

2.1335

1.6464

7.7773

3.6907

4900

84 N.B.

E.M.F.	205 – 205	1360
Res	$\frac{2000 + 31400}{200}$	167 Res
		34 R
C	48	

Hg in glob and very blue

E.M.F.	172 – 172
Res	$\frac{31400 + 3500}{200}$
C	16

136 : 164 :: 167 : 167 + x

164

668

1002

167

136) 27388 (201

272

188

201

167

.34

2

3) 208
69
138

31400
2200
20) 33600 168
20
136
136
160
160

2.1399
2.1399
1.6464
7.7747
3.7019

5030

85

ENA 208 − 208
Res $\frac{31400 + 2200}{200}$
C 48

1380
168 Res
31 ohms

ENA 175 − 175
Res $\frac{31400 + 3700}{200}$
C 16

138 : 164 :: 168 : 168 + x
164
672
1008
168
138) 27552 (199
138
1375
1242
1332
1242
90

199
168
31

138
9
1242

3/207
69
2
138

2
31400
4400
20)35800
20
158
160
18

2.1399
2.1369
1.6464
7.7479
3.6741

4720

155 2.1903
2.1903
1.6464
167 7.7282
3.7552

5690

8153

86

EM 207-207 1380
Res. 31400+4400 179 Res
33R
C 48 · 200 blue

EM 176—176
31400+6000
200
C 16

138:164::179:179+x
164
716
1074
179
138)29356 (212
276
175
138
376
276

110
2x2
179
33

3)208
69
1380

31400
2800
200)34200 (171

2.1399
2.1399
1.6864
7.7670
3.6932 4980

171
164
684
1026
171
138)28044 (203

149 2.1732
2.1732
172 1.6464
7.7645
3.7573
5720

444
384
8153
1732
7645
7530
2470

203
171
32

177
172
+5

87

EM7	207 − 210
Res	$\frac{31400 + 2800}{200}$
C	48.
	Blue in the glob
EM7	175 − 175
Res	$\frac{31400 + 4300}{200}$
C	16

1380
171 Res
~~172~~
32R

138 : 164 :: 171 : x + 171
164
684
826
171
138)26044 (188
138
1224
1104
1204
1104

138
6625

1387
1242

188
171
17

3)206
68
136

314000
5600
20)37000
185

2.1335
2.1335
1.6464
7.7328
3.6462 4430

152 2.1818
2.1818
1.6464
183 7.7375
3.7475
5590

+1

88.

Em7	205 − 207	1360
Res	$\frac{31400 + 5600}{200}$	185 Res
C	48 little blue	.37R
Em7	170 − 172	
Res	$\frac{31400 + 7800}{200}$	
C	16	

136 : 164 :: 185 : x : 185

164
740
1110
185

185)30340 (222
272
314
272
390
...
2

222
185
37

3(212
77
142

37650
3100
20)00750
203

203)893260 (4352
712
1066
510

203
164
812
1218
203
142)33492 (235
509
426
832
720
112

203
32

155 2.1903
2.1903
1.6464
204 7.6819
37089

5110

89

Em7	210 – 213
Res	37650 + 3100 / 200
e	48

1420
Res 203
4352
32

Em7	180 – 180
Res	37650 + 4700 / 200
e	16 e

142 : 164 :: 203 : 203+x

164
812
1218
203
142) 43292 (304
426
692
568
124

304
203

3) 187
62
2
1240

31400
1500
20) 32900 (164
20
128
120
89

164) 681168 (4153
656
251
164
876
820
568
492

164

141 2.1492
2.1492
1.6464
164 7.7852
3.7300
5370

8153
1492
7852
7497
2503

178
164
+14

90 [illegible]

Ent 187 — 187

Res $\frac{31400 + 1500}{200}$

e 48

1240
164 Res
4153 f [illegible]

52 R

Ent 160 — 164

Res $\frac{31400 + 3000}{200}$

e 16

216
164
52

124 : 164 : 164 : x 164

124) 26896 (216
248
209
124
856
744
112

216
164
52

3)198
66
132

31400
66000
20)32000
160

168) 772024 (4825.

91 [illegible]

EM7	198 — 198	1320
Res	31400 + 600 / 2000	160 Res; 4825 [illegible]
@	48	38 R
EM7	165 — 165	
Res	31400 + 2100 / 2000	
@	16	

132 : 164 : 160 : x + 160

9840

132) 26240 (198

198
160
38

7153
1303
8356
7812
2198

166
146
+ 20

135.

143.7

3/221
73
2
146

3/400
48000
20) 36000
180

180) 944300 (5246 180
900
443
366
830
720
1100
1080
20

153 2.1847
2.1847
1.6464
196 7.7077
3.7235

5290

Right

Oct 5 92

EWI	221 - 222	Res 1460 180 lbs 5246
Res	31400 + 4600 / 200	22 R
C	48	
EWI	180 - 180	
Res	31400 + 7000 / 2000	
C	16	

146 : 164 :: 1180 : x=180
13120
164
146) 29520 (202
292
320
292

480
22

3 | 230
76
15 2

200 | 10235
5111.7

152 : 164 :: 200 : 200+x
152) 32800 (215
304
240
152
880

161 2.2068
2.2068
1.6464
7.6655
216 3.7255

5310

'93

230 – 230   1520
Res 37650 + 24000 / 200   Res 200
Res 5117
15R
C 48

200 – 200
Res 37650 + 5600 / 200
C 16

37650
2000
200) 40050 (
199
195
200

215
200
15

.94 [illegible]

when put in there
was an are at the
clamps

3/211
72
140

43000
37400
20 (35700

178) 868280 (4877
912
1562
1424
1388
1246
1420

178
500

178
1424
48

2.1461
2.1461
1.6464
7.7496
3.6882 4880

95 Tae

1400
178 Rs
4877 ft lbs

EM 212-210
Res 43000 + 31400
200
30R
C 48

Out 180 - 180
Res 6300 + ~~42~~ 31400
2000
C 16

140 : 164 :: 178 : x + 178
164
712
1068
178
140) 29192 (208
280
1192
1120

178
30

3213

71
142

31400
5600
37000
185

185) 89326 (4825

1532
1480
526
370
1560

185
185
95
185
1480

E.M.F. 212 — 215 1420 185 4828 ft lbs

Rs 31400 + 5600 / 2000 28R

C 48

Emf 180 — 172

Rs 31400 + 7700 / 2000

C 16

283
185
28

142 : 164 :: 185 : x + 185
164
740
1110
185

142) 30348 (213
284
194
142
520
426

3(210
140

167
5
835

31400
2100
20)33500(1675
20
135

167)868880(5199.150
835
332
167
1658
1503
1550

167
1503

97

Emp	208–212
Rs	$\frac{31400 + 2100}{200}$
C	48

167 Rs
140 U
5199
R 28

Gl	173–175
Rs	$\frac{31400 + 2100}{200}$
C	16

140 : 164 :: 167 : x + 167
164
668
1002
167
140)27388(195
140
1338
1260
788

195
167
28

72
2
144

171
5
855

171) 9186
855
636
513
1230
1197
330
342

(5377

171
7
1197

138

190

98

v 144
Reo 171
Albs 5371

314 + 2
48
23+171

186 − 186
16
314 + 48

144 1164 :: 171 : x+171
164
684
1026
171

144) 28044 (194.
144
1364
1296
688
598

144
8
1152

144
4
576

194
171
23

This Lamp was
busted when I
received it.
Jim

229
76
152

31400
9500
20)40900 (204

204)1023500 (5017. 20/10
350
204
1510
1428

b : c :: 204 : 204 + x

b : c :: a : a + x

152 : 164 :: 204 : x + 204

100

Eu 228 — 230 v 152
Ro 204
R 31400 + 9500 fls 5017.
e 48200 16 + 204

Eu 200 — 200
Ro 31650 + 500
e 16

204 204/22/6

152 : 164 :: 204 : x + 204
164
152)33456 (224
304
305
304
16

1	16	23	12	47	20	74	25
2	23	24	18	48	22	75	26
3	28	25	23	49	36	76	9
4	28	26	18	50	13	77	15
5	30	27	26	51	49	78	7
6	15	28	2	52	20	79	12
7	22	29	16	53	32	80	[illegible]
8	38	30	10	54	20	81	23
~~8~~	~~3~~	31	25	55	×2	82	14
9	52	32	17	56	×4	83	25
10	32	33	28	57	13	84	21
11	37	34	8	58	24	85	
12	32	35	15	59	26	86	
13	33	36	20	60	12	87	
14	31	37	×5	61	24		
15	34	38	14	62	5		
16	24	39	22	63	29		
17	18	40	7	64	28		
18	10	41	25	65	13		
19	26	42	29	[illegible]	22		
20	24	43	28	[illegible]	29		
21	14	44	29	[illegible]	27		
22	35	45	9	[illegible]	33		
		46	32	70	23		
				71	7		
				72	29		
				73	10		

~~2939/3638 R~~

2939

3638)2939.0(.82

28504

8860

.. 82 Webers

48 candles

Volts	R
147	188
143	172
152	188
137	154
140	167
154	195
158	188
156	180
156	182
143	178
143	177
156	209
141	183
146	177
137	169
142	179
143	204
146	179
154	201
140	168
2939	3638

1363) 9210 (.67
8178
10320
9541

80
7
560 Webers
in my system

.82
.97.0
574
738
.67) 79.54 (118 lamps of
67 16 candles
125 through 1 brush
67
584

118) 800 (7 brushes to carry
826 800 lamps the

16 Candles

Volts	Ohms
122	179.5
132	219.25
120	177
127	166
143	222
141	205
136	194
7) 921	1363

TAE

.67

20000
65.125
14.875

1.8137
1.8137
3.6274
2.3446
1.2828

1.1723
2
2.3446

19½
2d

Page		Page		Page	
1		30	125	65	175
2	99	31	147	6	39
3	73	32	63	7	111
4	71	33	93	8	57
5		34	207	9	67
6	77	35	83	70	127
7	91	36		1	179
8	101	37	71	2	87
9	39	38	193	3	41
10	79	39	77	4	141
11		40		5	
12	81	1	171	6	107
13	95	2	149	7	145
14	75	3		8	133
15	179	4	41	9	119
16	189	5		80	209
17		6	155	1	197
18	195	7		2	97
19	159	8		3	143
20	123	9	51	4	173
21	191	50	177	5	201
22	185	1	183	6	
23		2	129	7	
24	65	3	51	8	
25	139	4	47	9	
26	59	5	163	90	
27		6	109	1	
28	39	7	135	2	
29		8	47	3	
		9	151	4	
		60	169	5	57
		1	121	6	165
		2	105	7	201
		3	103	8	
		4	115	9	
				100	137

	Before Ft lbs	After Ft lbs	Before Ohms	After Ohms	
1	5090	5460	188	159	Pt
5	5200	5080	167	166	~~Pt~~
17	4790	5760	179	202	
36	5020	4970	183	182	~~Pt~~
40	4880	4720	163	156	~~Pt~~
43	4930	5600	171	178	
45	4320	5300	212	214	
47	5077	4860	171	166	~~Pt~~
75	4910	5450	162	164	
86	4720	5690	179	187	
87	4980	5720	171	172	
88	4430	5590	185	183	
89	4352	5110	203	208	
90	4153	5370	164	164	
91	4825	5530	160	145	Pt
92	5246	5290	180	196	
93	5117	5310	200	216	
98	5371	5820	171	190	
	18) 87411	18) 96630	178	180	
	4800 Ft lbs before	5368 Ft lbs after			

~~Westinghouse clamps~~

RGE

Volt

91, 98, 36, 17, 43, 47, 40, 45, 1, 75, 5, 92, 90, 89, 93, 88, 87, 86

1, 5, 17, 36, 40, 43, 45, 47, 75, 86, 87, 88, 89, 90, 91, 92, 93, 98

1	147	140
5	140	138
17	142	162
36	144	143
40	134	129
43	148	150
45	144	160
47	140	135
75	134	142
86	138	155
87	138	149
88	136	152
89	142	155
90	124	141
91	132	135
92	146	153
93	152	161
98	144	158
	18) 2525	18) 2708
	140 average	150 average

2 above

16 Below

9d

9

32 Pt Clamps

4 ~~Broken~~

6 ~~garden~~ TAE

64 nickel

3 nickel pour carbons

13 garden

Dull red

30 Volts

37650
9
46650
233 Ohms

26 Volts just red

26 : 164 :: 260 : 1640

26 : 164 ::

X black X red

X red X black KKE

卌 卌 卌

||| 卌

|||

8 18

卌 卌 卌

卌 卌 卌 ||||

卌

10 24

| 卌 |||

Between 0 - 200 minutes

Ohms	
4750 — 5000	10
5000 — 5250	3
5250 — 5500	5
5550 — 5750	2
5750 — 6000	5
6000 — 6250	0
6250 — 6500	1
	26

Ohms	
150 — 162.5	1
162.5 — 175	2
175 — 187.5	7
187.5 — 200	7
200 — 212.5	5
212.5 — 225	1
225 — 237.5	2
237.5 — 250	1
	26

AWS

Between 200 - 400 minutes
Hlhs

4500 - 4750	1	
4750 - 5000	8	
5000 - 5250	6	TKG
5250 - 5500	5	
5500 - 5750	3	
5750 - 6000	0	
6000 - 6250	2	
6250 - 6500	1	
6500 6750	1	
	27	

Ohms

150 - 162.5	2
162.5 - 175	5
175 - 187.5	6
187.5 - 200	7
200 - 212.5	6
212.5 - 225	1
	27

Asum 400 on

4000 – 4250	2
4250 – 4500	4
4500 – 4750	1
4750 – 5000	8
5000 – 5250	9
5250 – 5500	2
5500 – 5750	0
5750 – 6000	0
	26

TKE

150 – 162.5	2
162.5 – 175	9
175 – 187.5	7
187.5 200	3
200 212.5	5
212.5 225	0
	26

From 0–200

	Above	Below Average
Ft lbs	17	14
Ohms	14	11
Volts	19	8

TAE

200–400

	Above	Below Average
Ft lbs	7	20
Ohms	14	13
Volts	11	16

[illegible]

	Above	Below Average
Ft lbs	0	7
Ohms	4	4
Volts	1	7

11 ⌐1656
150

2583	3.4121	2583
17	1.2304	1656
	2.1817	⌐1927
152		154

3362	3.5266	3362
	1.2304	2124
197.6	2.2962	⌐1238
		206

marked mistake

88095	4.9450	~~5244~~
	1.2304	88095
	3.7146	57685
5180		⌐30410
		5068

Average of lamps that ~~case~~ burnt the resistance

Coils 17 lamps 0-200 minutes out of 26 lamps

TAE

	Volts	Ohms	Ft. lbs
			5500
26	154	191	5780
32	160	196	4750
24	160	239	4735
69	144	194	5400
4	137	154	5250
37	148	185	5446
3	152	188	5040
14	148	195	5380
6	154	195	5090
10	143	178	4920
12	156	209	
1	147	188	5090
33	162	233	4996
76	150	199	5008
56	166	201	5642
67	152	207	4944
79	156	210	5130
	2583	3362	88095
	6	6	4

average 11 lamps Volts 150 ~~Ohms~~

1656 · 150 6 lamps 154

Ohms 193 ~~Volts~~

2124 · 193 · 206

57685 5244 5068

5244 ft. lbs

Average

~~1~~52 Volts 197.6 Ohms 5180

+ 1762	2192	at 6516
168	+ 192	− 62977
1930	2384	69493
1214	1512	43234
716	882	26259
143	176	5252

1762	3.2466
12	1.0792
147	2.1668
2192	3.3408
12	1.0792
182.5	2.2616
62977	4.7994
12	1.0792
5260	3.7202

Average lamps that burnt their resistance coils from 200 – 400 minutes 13 Lamps out of 27.

			6516
52	168	192	5656
30	142	158	4819
78	144	191	6348
57	164	Tel 188	5253
74	154	200	4800
77	146	8 lamps 197	4850
42	148	192	5001
59	148	194	5046
46	142	177	5480
19	146	179	5317
65	142	168	5246
51	146	180	5170
22	146	168	
	1762 (143)	2192 (176)	62977 (5252)

1214 / 152   1512 / 186   43234 / 5404

147 Volts, 182.5 Ohms, 5260 Ft.lbs.

9)8 / 9

From 400 – 48
2 out of 8 burnt resistances

81	146	198	4778
50	158	206	5457
	304	404	10235
	152	202	5117

72

TAE

~~LF~~ 15

Total lamps 0 – 100 minute

Volts	Ohms	Ft-lbs
1656	2124	57685
630	786	22463
2)2286	2910	80148
1143	1455	40074
163	208	5725

6 + 6 = 12 lamps from 100 – 200 minutes

927	1238	30410
910	1147	31725
2)1837	2385	62135
6)918	1192	31067
153	199	5178

Average lamps that did not burn resistance ~~from~~ 0 – 200 minute 10 lamps

49	174	213	6296
~~53~~			
95	140	178	4877
~~68~~			
39	152	172	5950
35	164	223	5340
7	630	786	22463
13	157	198	5616
2	158	188	5880
8	141	183	4810
63	143	172	5260
64	156	180	5996
	152	191	4918
	160	233	4867
	910	1147	31725
	151	191	5287

TAE

14 ~~8~~ lamps Total

1214
908
2122
1061
152

1512
1121
2633
1316
188

3.3267
1.2788
2.0479

43234
31864
75098
37549
5364

3.4205
1.2788
2.1317

4.8752
1.2788
3.5964

13 Lamps

716
1183
1899

882
1487
2369

26259
41804
68063

146
3.2785
1.1139
2.1646

182
3.3745
1.1139
2.2606

5230
4.8329
1.1139
3.7190

Average Lamps
from 200 - 300 minutes
that did not burn
resistances
6 lamps

61	156	179	6022
20	154	201	5230
70	156	201	4959
100	152	171	5017
25	142	158	5656
31	154	211	4980
	908	1121	31864
	151	187	5301

8 lamps
300 - 400 hours

55	164	198	6017
96	142	185	4828
60	166	214	5704
41	148	208	4660
84	136	167	4900
71	144	169	5435
15	146	177	5346
16	137	169	4920
	1183	1487	41804
	148	187	5225

S Total

841	1090	28819
304	404	10235
1145	1494	39054
143	187	4882

400 – 500 ~~hours~~ minutes

6 lamps that did not burn

38	128	177	4230
18	143	204	4440
97	140	167	5199
34	148	189	5130
85	138	171	4980
80	144	182	4840
	841	1090	28819
	~~105~~ 140	182	4803

TAE

Blue at clamps

0 — 100 5 lamps

Ohms	Volts	Cdles
213	174	6290
217	162	5357
196	160	5760
185	148	5250
172	152	5950
983	816	28607
197	163	5721

TAE

100 — 200 hours

1 lamp Cds.

150 Volts 199 Ohms 5008

Blue. at clamps
200 – 300 ~~hours~~ minutes

9 lamps

Volts	Ohms	Ft lbs
	179	6022
156	201	5230
154	158	5656
142	192	6516
168	180	5246
146	204	5017
152	158	5656
142	211	4980
154		
148	194	5001
1342	1677	49324
149	186	5480

KG

300-400 ~~hours~~ minutes

Blue at Clamps

6 Lamps

Volts	Ohms	Ft Cdls
146	1.79	5480
164	198	6017
166	214	5706
144	169	5435
146	180	5246
140	168	5170
906	1108	33054
	185	5509

Volts 151 / Ohms = 3.42 / Ft Cdls = 6332 ft

9.16 / 6.6

TAE

 ~~Lot 1~~

Blue at clamps

Average of 27 Lamps

	Volts	Ohms	ft-lbs
6	879	1157	29514
5	983	816	28607
1	150	199	5008
9	1342	1677	49324
6	906	1108	33054
27	4260	4957	145507

27/4260/157
270
156
135
210
189
21

Average Volts = $151\frac{16}{27}$
" Ohms = $152\frac{20}{27}$
" ft-lbs = $5352\frac{1}{4}$
of 27 lamps.

Volts.	Ohms.	ft-lbs
6–906	1108	33054
9–1342	1677	49324
5–816	983	28607
6–879	1157	29514
1–150	199	5008
27–4093	5124	145507

400–500 meter

Blue at clamps
6 Lamps

18	143	204	4440
82	146	198	4770
50	158	206	5457
97	140	178	4877
34	148	189	5130
80	144	182	4840
	879	1157	29514

146	193	4919
197	163	5721
150	199	5008
149	186	5480
151	185	5509

TAE

15 1.1761
91 1.9590
.2171

16.5

5 ~~0.6990~~ 06990
~~1.9590~~ 1.9590
~~.2191~~ .7900

12. 1.0792
1.9590
.1202

9)13
14.3

13.2

6. 0.7782
1.9590
.8192

6.6

14 1.1461
1.9590
.1871

Lamp 87 1475

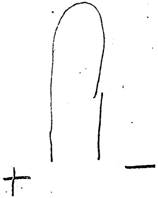
resistance burned

without lamp lighting

Lamp 43

resistance burned

5



TAE

$$89)\,86.00\,(96.6$$
$$\underline{801}$$
$$590$$
$$\underline{534}$$
$$560$$

$\begin{array}{r} 480 \\ 20 \\ \hline 460 \end{array}$ $\begin{array}{r} 98 \\ 27 \\ \hline 71 \end{array}$

No 86 480

15 m.

Completely wrecked

No 45

1 45 P.M

Glass broke

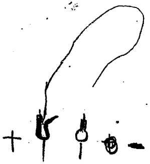
$\begin{array}{r} 460 \\ 45 \\ \hline 505 \end{array}$

TAE

No 75

2 - 35 P.M

$$\begin{array}{r} 520 \\ 25 \\ \hline 545 \end{array}$$

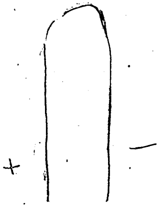


Burnt resistance

No. 93

2-40

$$\begin{array}{r} 520 \\ 40 \\ \hline 560 \end{array}$$

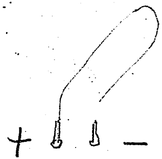


TAE

No 9,0

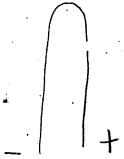
3-32

Burnt resistance



520
60
580
32
612

No 92

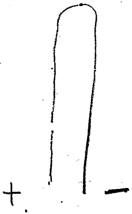


3-45

580
45
625

No 5

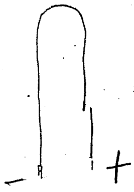
4 P.M



580
60
640

No. 36

4-35



Resistance O.K

640
35
675

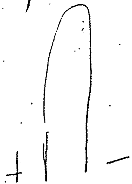
No 17 blue on clamps

88 ——

89 ——

98 ——

89 4-50



640
50
590

TAE

98 4-52

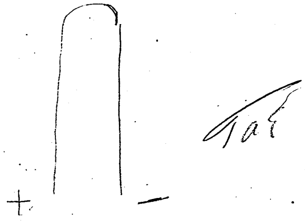
Went completely in glass

JAS

Lamps tested

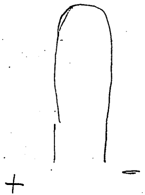
	Volts	Ohms	Sh. lbs.
1	143	178	5090
17	broken in test		
40	133	155.2	5050
47	140	166	5220
88	broken in testing ~~149~~	~~[illegible]~~	~~[illegible]~~
91	140.	144	6030

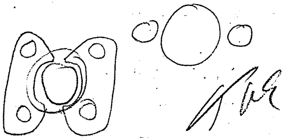
No 1

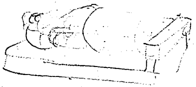


Did not burn resistance

No 90





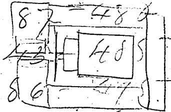


82 — 127

85 — 493

80 — 475

87 — 480



43 — 485

86 — 495

45 — 505

75 — 555

93 — 560

1st lot—Test lamps (100 Test)

No of Lamps	Time in Minutes	No of Lamps	Time Minutes	No	Time	No	Time
54	1	13	124	77	281		
58	10	2	128	31	282		
49	22	8	130	42	284		
53	23	63	133	59	295		
95	27	62	139	46	309	85	473
68	29	76	142	19	314	80	475
26	30	56	153	55	324	87	480
32	40	67	155	96	329	43	485
24	44	64	172	60	351	86	495
69	48	79	187	41	352	45	505
4	56	61	209	84	354	75	555
37	57	20	214	65	355	93	560
3	69	30	215	71	356	90	612
14	70	70	217	15	369	92	625
39	74	52	220	51	374	5	640
6	82	78	235	22	376	36	675
10	87	+ 57	239	16	382	89	690
12	94	100	264	21	385	98	692
35	95	25	266	38	409	80 Total lamps	8042
72	111	74	269	18	421		
7	117	83	271	81	440		
33	123			50	443		
				97	444		
				34	459		
	1309		3836		8488		
82	127						

1309
3836
8488
8042

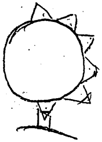
80 | 21675 | 270 min
1600XX
567
560
75

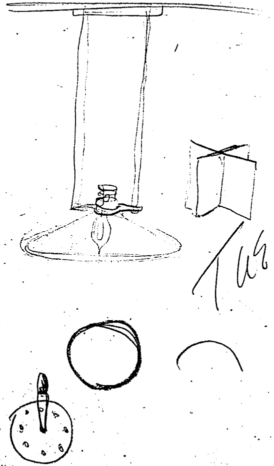
Average time of 1st lot

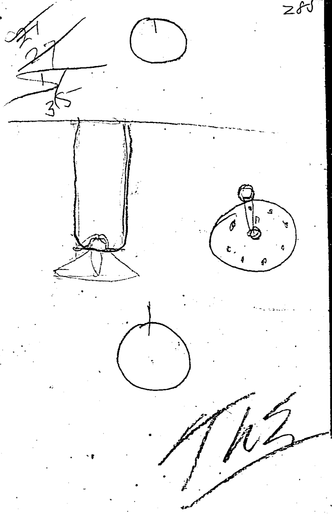
When no 82 & 51 are added makes a total of minutes.

82 / 22841

268 average







Menlo Park Notebook #120 [N-80-11-25]

The dated entries in this notebook cover the period November-December 1880, but the book was probably begun earlier in the year. All of the entries are by William J. Hammer. Most of the material relates to the gathering of statistics for the Pearl Street district. Included are statistics that were copied from block survey books of the district and from answers to questions asked by the surveyors. There are also tables of tests relating to the second lot of one hundred lamps sent from the lamp factory to the laboratory for testing, a table of the first lot, notes and drawings of lamp experiments, and a drawing of a Brush arc light. The label on the front cover is marked "Electric Lamps Statistics &c &c Figuring," and "Wm. J. Hammer." The book contains 284 numbered pages and has been used in both directions.

Blank pages not filmed: 1-2, 9, 50-53, 90-91, 112-117, 120-123, 128-237, 240-245, 248-255, 270-271, 274-277, 282-283.

Missing page numbers: 3-8, 11-12, 21-22, 261-266.

The next three pages contained figures from which the annexed Table was compiled.

Hammer

Second Lot of 100 Test Lamps.

Number of Lamp	Volts before Test.	Volts after Test	Ohms before Test	Ohms after Test.	Ft-Lbs before Test.	Ft-Lbs after Test.
13	144	161	158	196	5813	5850
18	144	158	169	197	5438	5470
22	136	147	138	140	5937	8450
29	136	147	169	183	4850	5160
36	153	155	178	158	5820	6730
37	140	147	169	164	5120	5840
40	135	143	157	159	5140	5630
42	131	150	151	164	5020	6070
43	137	142	164	159	5060	5820
46	136	144	157	broken	5230	broken
51	137	133	154	147	5400	5300
53	133	135	158	148	4900	5450
57	141	143	179	164	4920	5800
67	127	137	137	127	5220	6060
69	130	131	140	139	5350	5460
70	136	—	157	—	5220	—
83	130	156	158	172	4850	6260
84	129	135	157	161	4700	4580
98	127	139	140	137	5100	6240

4
26
50
72
97
2
17
38
83
0
19
52
80
19
57
79
98
12
52
87
9
79
3
67
40
25
20
20
4

1251

4700
1251

20) 5951

297 squares.

Average
per verification.

Belonging to Lot-1

List of 32 Lamps of Lot-1 which burnt their Res.

No	Min	No	Min
26	30	74	269
32	40	77	281
24	44	42	284
69	48	59	295
4	56	46	309
37	57	19	314
3	69	65	355
14	70	51	374
6	82	22	376
10	87	50	443
12	94	81	440
72	111	32	3740 6197
33	123		
76	142		
56	153		
67	155		
79	187		
30	215		
62	220		
78	235		
57	239		
	2457		

Average time of burning min. 198

289
288
1

32/6197/198 min average
32
299
288
117
96

~~88~~ Lamps lasting ~~3333~~ minutes.

No	
40	1350
47	1050
1	745
17	703
90	790
91	701
9	103
7	5442
82	
89 Total	

22159
5442 minutes

$89\overline{)27601}$ ~~310~~ ~~Average~~
267XX
90
89
11
89

308 min
average

No.	Min.	No	Min.				
49	6	59	130	12	260	75	570
4	16	56	131	73	277	41	594
77	20	58	133	39	281	6	608
87	30	65	133	33	293	62	630
93	34	61	135	82	295	55	673
52	41	86	138	8	325	15	740
10	45	26	138	72	340	90	783
47	49	27	138	28	361		
24	53	79	144	1	368		
48	56	66	153	19	368		
78	65	54	162	64	368		
60	68	38	169	23	373		
11	70	17	171	91	375		
85	73	94	175	25	378		
81	78	45	176	2	392		
47	80	68	176	88	403		
14	90	44	180	89	438		
92	98	96	181	50	448		
9	108	1	190	80	473		
3	113	21	203	5	496		
31	119	32	203	16	523		
95	120	76	203	20	527		
7	121	35	214	63	530		
74	123	71	238				
		34	243				

over on next page,

8 - 241
11 - 812
15 - 1922
10 - 1734
6 - 1304
5 - 1406
2 - 665
7 - 2615
3 - 1289
2 - 969
3 - 1580
2 - 1166
2 - 1238
1 - 673
1 - 740
1 - 783

79 — 19137

1 - 808
1 - 808
1 - 813
1 - 816
1 - 816
1 - 821
1 - 828
1 - 845

6550

6 - 903
1 - 912
1 - 919
1 - 925
1 - 940
1 - 970
1 - 1130
1 - 1182
1 - 1220
1 - 1315
1 - 1355

98 - 11771
6550
Lumps: 19137
98) 37458
382

N.Y. Gas Light Co. 102 consumers. Book 4

Mutual " " 17 "

Mutual City Gas 8 "

Kerosene 33 "

Candles 9

Do not use any light 9 parties.

No of Jets without globes = 1036
" " " with clear " = 134
" " " " ground " = 279
" " " " Tin Shades = 32

Did you ever notice any perceptible leakage — Yes 76, No = 0, Dont know 1

Are you bothered with the heat
Yes = 42
No = 77

over

Do you use gas jumps { Yes 128
No 2

Do you use gas for heating.
{ Yes. 30
No.. 96

used for following purposes
glass blowing = 3 parties.
heating glue = 10 "
Soldering = 7 "
Embossing = 2 "
laboratory use = 1 "
heating irons = 1 "
Varnishing = 1 "
showroom = 1 "
heating = 3 "

Style of flames.

4	5	6
32	98	1

2 Reflectors = 4 jets each.
2 " = 5 " "
6 " = 6 " "
2 Chandelier 4 " "
6 segar lighters.

Are there times when you have to regulate the jet to keep it right when it is varied by difference in pressure.
Yes. 126
No - 3

Do you like the gas sold you
Ye. 51.
No 74.

Is it found that the 50 Grains of Sulphur thrown into the atmosphere at your place, damages your paint or good. Yes 0 No 125

Did you ever take gas from any other Co.? if so which, & how does it compare with this.

Yes = 12

No = 122

Remarks. 3 = Use Mutual like N.Y. best
2 = " N.Y. " Mutual "
2 = " " " " N.Y. best
2 = " both Co's gas,
2 = " Can see no diff.
2 = Had Mutual smelled
1 too much to use.

Do you use an Engine? - if so Whose?

1	Hewes and Phillips	80	Horse Power
1	Buckeye Engine	30	" "
1	Allen Cut-off	50	" "
1	Roper Caloric	2	" "
1	Hubbard & Allen	6	" "
2	Otis Bros.	10	" "
		10	" "
6	Baxter Engine	8	" "
	" "	10	" "
	" "	4	" "
	" "	4	" "
	" "	4	" "
	" "	10	" "

Continued on next page.

{ Erie Engine — 40 H.P.

1 { Snedicor " — 10 H.P.

1 { Hittenger Cook & Co — 40 H.P.

Dont know maker's name

2 { 1 — 8 × 8
1 — 8 × 7

Also 2 Duplex air pumps

Is your Boiler Horizontal or upright —?

Horizontal 9

Upright — 2

Do you rent power if so how much do you pay for the whole or per H.P.

$150 year	45.00 month	4.00 week	$ 181.50
500 "	5.00 "	3.00 "	Total per month
150 "	12.50 "	6.00 "	

7 have it included in their rent.

3 Gave no definate amount

How much Horse Power do they charge you for

Total Amt. 108 H.P

Did not know. 4 parties.

Would not tell. 1

Note- fewer parties answered this question than the next.

How much do you think you use?

Total 236 Horse Power.

2 parties use all they can get.

2 Dont know.

Note, almost all the subscribers think they get or use less than is charged them but he collected many more answers to this question, hence seeming discrepancy in amounts.

What proportion of the time do you use it:

All the time	28
2/3 of time	2
1/2 " "	2
3/4 " "	1
Nearly all the time	1

How much coal do you use per day week or month.

Total 63 1/2 Tons per week.
1 1/2 Chaldrons of coke.

Note. it will be remembered many hire their power.

Have you any machinery driven by foot power.

~~[illegible]~~ 83 parties — No 95

Employed as follows.

1. spinning wheel
1 - (2) blowers for (3) rollers
1 - cutter.
1 - 30 lathes.
1 - 4 machines
1 - 2 "
1 - 4 stove pipe machines
1 - 5 lathes.
1 - 7 "
1 - 2 presses

1 - 4 presses
1 - 1
1 - copper cutter
1 - press
1 - 2 lathes
1 - spindles
1 - 6 machines.
1 - 7 lathes.
1 - 6 lathes.
1 - 1 press
1 - 4 presses

This on next Page

(over)

Have you any machinery driven by foot power?

Yes	No
1 for spinning wheel.	||||. ||||. ||||. ||||. ||||. ||||
1 " Bellows for flowers.	||||. ||||. ||||. ||||. ||||. ||||.
1 " Cutter	||||. ||||. ||||. ||||. ||||. ||||. ||||.
1 " "	95 No
1 " 30 Lathes.	
1 " 4 machines	1 - 6 lathe.
1 " 2 "	1 - 1 press
1 " 4 stovepipe machines	1 - 4 "
1 " stamp machine	1 - sewing machines.
1 " 5 lathes	1 - 6 " lathes.
1 " 1 "	1 - Embossing machine.
1 " 2 "	1 - 4 lathes.
1 - 4 presses	1 - 2 lathes.
1 - 1 "	1 - ~~for~~ Bellows
1 - 1 "	1 - sewing machines.
1 - 1 copper cutter	1 - lathe
1 - presses	33 parties Yes.
1 - 2 lathes.	
1 "	
1 " Spindle	
1 " 6 machines	
1 - 2 lathes	

How far do your vaults extend toward the curb or edge of sidewalk.

Even with the curb	6 ft	Within 8 ft	Within 9 ft
~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~	/	/	/
~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~			
~~||||~~ ~~||||~~ //	/	/	/
52			

Have you good ventilation or are your rooms oppressive in summer. ?

Yes	Fair	No
~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~	~~||||~~ ~~||||~~ ~~||||~~	////
~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~	~~||||~~ ~~||||~~ ~~||||~~ /	4
~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~	31	
~~||||~~ ~~||||~~ ~~||||~~ ///		
88		

What is your insurance rate.

1/2 per ct	2 per ct	3/4 per ct	2 1/2 per	1 per ct	1 1/4	2 per ct	2 1/4	35 per ct	[illegible]
9 +	5	9	2	27	4	5	10	7	[illegible]

40 per ct	45	50	60 per ct	65	70 per ct	75	90 per ct	80
18	11	6	7	1	2	3	1	2

Don't know 6

What time Do you close in

Winter. and Summer.

Winter		Summer	
4	3	4	3
4 30 / 5	3	4 30	1
5 30	19	5	3
6 00	109	5.30	20
7	8	6	109
8	4	7	7
10	6	8	3
		10	6

Have you a Hoistway

Yes	Elevators
~~||||~~. ~~||||~~. ~~||||~~. ~~||||~~. ~~||||~~	2 steam.
~~||||~~, ~~||||~~. |||	1 "
38	1 "
	1 "
	1 "
	1 "
	1 "
	7 " seven elevators
	17

Book 5
Commencing at 146 + 148 William St
to Fulton to Gold to Ann St.

From South West cor Beekman
and William. to Nassau, to Ann
down to 57 + 59 Ann.

Book No 2

What Co. supplies you with gas.

Mutual	N. York
10 Mutual	162 N.Y.
Kerosene	**Candles**
48 Kerosene	12 Candle
Do not use any light	**Decline to give inf.**
18 none	1

Continuation of Book 2

What is the actual no of burners from 8 am, to 5 P.M. in Summer.

1/2 light	70	use only on cloudy days 1

What is the no burnt from 8 am, to 5 P.M in Winter.

1/2 light	88	use only on cloudy days 1

From 5 to 6 P.M in ~~Winter~~ Summer	From 5 to 6 P.M in Winter.
1 86	20-8, 12, 6; 12-9-6 5-7-4-12-24; 25-21-39-23 6-24-13-30-14-10-18-22 18-17-7-22-7-11-8-15 8-35-30-32-13-35-39 70 53 98 135 135 226 717 53 98 135 135 226

51
32
23
133
106
83
60
33
30
42
114
41
31
88
45
21
39
1044

6

64
37
16
25
44
33
41
263

3

Continuation of Book 2.

From midnight to 8 A.M.

𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. |||

53.

How many gas jets have you without globes.

𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 1 - 51

61. 66. 19. 6. 43. 110 - 76 - 30 - 9 - 24, 24. 36. 6. 27

22. 8. 21. 21. 70. 44. 21. 6. 14. 20, 11. 68. 20. 21. 24.

4. 17. 26. 13. - 1044

How many have clear glass globes

𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. |

51

How many have you with ground glass globes.

𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 1

76 = 𝍸. 𝍸. 𝍸. 𝍸: 18. 26.

64. 12. 12, 13. 16. 9. 4. 12. 6. 18. 9. 11. 21. 7. 5.

263

Tin Shades 3
|||

Do you use gas for Heating

Yes	no
18	75

How many ½ lights? If any groups of small jets are used how many? &c

	Segar Lighter
4	15

Do you use an engine If so
Whose make is it.

Wilson & Roache. Do not know the name of maker

Neal

Sedgewood & Co

Borden

Todd and Rafferty

Baxter Caloric.

Erie City

Hydraulic Hand presses.

How much coal do you use per day week or month for power.

1 Ton per week — 1 Ton per month
1 " " " — 10 " " "
1 " " " — $1\frac{1}{2}$ " " "
7 " " "

1 Ton per day

12
30
10
1
7
$1\frac{1}{2}$ Total
$61\frac{1}{2}$ Tons per month.

Do you have a specially employed engineer or does he other work, if so what proportion on the engine

1. No Janitor tends the engine. Yes
1 makes himself generally useful. ~~||||~~ . 1 = 6

Do you rent power If so how much do you pay per year for the whole or per H.P.

How many horse power do they charge you for.

1 Horse Power.
1 " "
4 " "
10 " "
20 " "
3 " "
39 H.P. Total.

How much do think you use

11 Horse Power. Dont know.
3 " "
15 " " Use a horse for hoisting.
29 ///

Do you use that power all the time if not what proportion.

Yes 1/2 the time.
11
2 yes

Have you any machinery driven ~~machinery~~ by foot power.

1 sewing machines. 1 – 4 card presses
1 " " 1 – 3 lathe machines
1 " " 1 – 1 sewing machine
1 " " 1 – 2 " "
1 " " 1 – 1 " " 18
1 2 drilling " 1 – " "
1 2 "

How far do your vaults extend towards the edge of the side walk, –

Even with the curb
𝍸. 𝍸. 𝍸. 𝍸. 1. = 21

1 (1) within 4 1/2 ft of curb
1 (1) " 4 " " "
𝍸 (5) " 5 " " "
111 (3) " 6 " " "
1 (1) " 7 " " "
23 = 111 𝍸. 𝍸. 𝍸. 𝍸 10 " " "
18 𝍸. 𝍸. 𝍸. 111 8 " " "
(29) 𝍸. 𝍸. 𝍸 9

2 = 11 within 13 ft of curb
1 = 1 within 12 ft of curb
3 = 1111 within 11 ft of curb
11 (2) Beyond the curb

Have you good ventilation.

Fair	Yes	Poor
𝍸. 𝍸. 𝍸. 𝍸	𝍸. 𝍸. 𝍸.	𝍸. 𝍸. 𝍸
𝍸 1	𝍸. 𝍸. 𝍸. 𝍸	𝍸. 𝍸. 𝍸
	𝍸. 𝍸.	1
26	45	31

What time do yo close

In Winter	In summer
9 — |||| — 4	10 — |||| — 5
5 — |||| — 4	5 — |||| — 4
5.30 — 卌 卌 卌 卌 ||| — 23	5.30 — 卌 卌 卌 卌 ||| 23
6 — 卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 || — 52	6 — 卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 || 52
7 — ||| — 3	12 — ||| — 3.
12 — ||| — 3	P.M. 3 — | — 1
P.M. 3 — | = 1	P.M. 11 — ||| — 3
P.M. 11 — ||| — 3	8 — 卌 || — 7
10 — |||| — 4	9 — |||| — 4
8 — 卌 || — 7	7 — ||| — 3

all the time — 卌

\|\| close at 7 P.M. open at midnight (restaurant)

What Co. supplies you with gas?

N. Y	Mutual.
107	17

Kerosene	Candles
27	8

City Gas	Do not use any light.
8	9

W. From 2 a.m to 7 a.m = 8.3.1. = 12

W. From 3 a.m to 7 a.m = 8.2.3.2.,2.5. = 22

W. From 4 a.m to 7 a.m = 4.3.3.3.3.4.2.1.2 = 30

W. From 5 a.m to 7 a.m = 3.4.2.3.5.3.3.3.3.8.8.1.8. = 55

W. From 6 a.m to 7 a.m = 12.2.2.56. = 72

S. From 5 a.m to 7 a.m = 3. = 3

From 4.45 P.M till daylight (7) a.m

56

What is the actual number of 3 jets burning from 8 a.m. to 5 P.M in summer

24 = 59

What number do you burn from 8 a.m. to 5 P.M. in winter.

24 = 120

Refer also to opposite page

H–

over.

From 5 to 6 P.M. in Winter.

卌. 卌. 卌. 26, 30 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌.
卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 117. 卌. 卌. 卌. 卌. 卌. 卌. 卌.
415. 125. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌.
30. 31. 39. 卌. 卌. 卌. 卌: 卌. 卌. 卌. 卌. 卌 卌. 卌. 卌. 卌.
卌. 卌. 卌. 40. 卌. 卌. 卌. =

321
56
117
415
125
100
40
1179 Total.

From 5 to 6 P. M. in Summer?

卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌 卌. 卌. 卌. 卌. 卌. 卌
|| = 77 Total.

How many gas jets have you without globes?

318 卌. 卌. 卌. 卌. 卌. 37. 卌. 卌. 卌. 卌. 卌. 卌. 卌卌.
64
47 卌. 卌. 卌. 卌. 卌. 卌. 卌 卌 卌. 卌. 卌. 卌. 卌. 卌. 卌.
372
37 卌. 卌. 卌. 64. 47. 372. 卌. 卌. 卌. 卌. 卌. 卌 卌 卌 卌
80
24 卌. 卌. 卌. 卌. 卌. 卌. 80. 24. 卌. 卌. 卌. 卌.
32
77 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌 ||| 24. 53.
1051
32.

How many have clear glass globes?

卌. 104. 17. 卌. 卌. 卌.

104
17
20
141

How many have ground glass globes?

159
51
117
327

38. 15. 卌 卌. 卌. 卌. 卌. 卌. 卌. 117. 卌. 卌. 卌. 卌.
卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌 卌 卌. 卌. 卌. 卌. 卌. 卌. 卌
卌. 卌. 卌. |||.

Zu Ohacle. 20. 8. 3. 2. 1. - 34

3

Do you use gas for heating.

Yes	No
2 Heating	106
1 " office	
1 " tea	
1 " sealing wax	
1 " coffee	

For argan light

1 heating iron
1 gas stove tea
1 glue pot
1 oysters
1 by barber
1 heating water

1 blowpipes
1 soldering

= 21

How many ½ lights, Many in groups of small jets are used, how many? How many in each group?

reflector
1
14 ref – 4 hrs ea
6 " – 6 " "

How far do you vaults Extend

Even with the curb

//// = 4 over the river

within 12 ft - //// = 4 + 2 = 6

within 9 ft - /////./////./////./// = 18

within 10 ft - // = 2

within 11 ft - /////.// = 7

~~within 12 ft - // = 2~~

within 8 /////./////.//// = 14

within 6 ft - // = 2

within 7 ft - / = 1

3

Have you good Ventilation

Yes	No
95	13

Fair

21

3

What time do you close in Winter & Summer.

15 = 5.30 – ~~||||~~ ~~||||~~ ~~||||~~
59 = 6 – ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ||||
8 = 6.30 – ~~||||~~ |||
27 = 7 – ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ||
4 = 9 – ||||
1 = 9.30 – |
1 = 12 – |
12 = 5 – ~~||||~~ ~~||||~~ ||
4 = 3 – ||||
1 = 3.30 – |
32 = 4 – ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ||
2 = 8 – ||
4 = 10 – ||||
1 = 11 – |

never close
|| = 2

all night –
| = 1

Book 5

From 8 A.M to 5 P.M.
Summer.

2	4	2
2	35	1
2	1	1
1	1	1
1	3	1
5	2	2
1	1	2
1	1	2
1	1	127
3	2	
13	1	
2	1	
1	1	
1	1	
1	1	
4	4	
1	1	
1	1	
5	1	
2	1	

76
51
127

Book 5

From 8 am to 5 P.M
Wailes

2	1	1
1	6	1
2	1	1
8	2	2
2	6	1
7	35	1
1	1	2
2	1	2
1	3	2
2	1	3
3	4	3
15	2	160
4	1	
1	2	
1	1	
1	1	
1	2	
6	1	
1	1	
1	1	
	4	

5

From 5 P.M to 6 P.M

~~Summer~~

Winter

25	5	3	4
10	12	[illegible]	2
6	7	13	10
10	20	8	6
7	5	8	6
5	4	15	12
14	20	4	6
6	4	9	26
12	6	6	1
8	7	12	6
26	7	2	6
10	20	14	6
8	3	3	10
4	2	8	6
20	35	8	6
3	1	4	4
30	1	4	6
12	8	2	20
6	1	8	4
12	10	8	15
30	20		12
			6
264	198	139.	180 = 781 Total

7

264
198
139
180
781

Book 5

From 6 P.M. to 7 P.M.
Winter.

2
6
10
7
2

27
26

53
4
3

60
1
13

74
2
1
13
2
4
1

97
6
4
1

108
8
6

122
1
2

125

Book 3

From 7 P.M to 8 P.M

Miles.

2
4
3

9
2
10

21
3
1
8
8
2
1
3
8

55
2
1
1
8

67
1
2

70

Mutual.	New York
卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. ||||	卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. 卌. |||| 卌
44	54

Kerosene	Candles
卌. 卌. 卌. 卌 卌 卌 卌 ~~[illegible]~~ 卌. 卌 卌 卌 卌 卌. 卌 卌. |||. = 79 parties	1. = 1
5.2.1.3.2.4.4.3.1.2.1.2.25	
2, 2. 2.1.2. 1.1.1.1.1.1.1.1.	
1.1.1.1.11, 3.5.4.4.1.1 2.1	
1.1. 2.1 1 1 1 1 1 1 1 1 1	
6.2.2.2. 2.1. 2.4.3 4.6.4.	
4.4. 4. 3. 6.31. 10.3.4.6	
2.5. 6.7. 4. 12	
= lamps	

Dont use any light

卌. 5

All Night.

2.1.1.2.1.1.2.1.3.2.1.1.1.1. = 20

8 to 10 =

1 = 1

8 to 9

3.5 = 8

9 to 10

10.3 = 13

10 to 11

8
26
1
12
6
6
12
6
6
3
6
20
4
15
16
12
6
10

252
165
8

Book 8

Gas Jets without Globes

18	25	12	4	2	25	4	10	1
20	7	12	20	8	23	30	12	24
14	2	4	1	2	10	16	10	6
6	8	6	20	4	9	6	2	6
14	1	8	20	2	9	25	4	6
4	6	8	4	10	12	4	2	
3	30	12	24	2	1	26	2	
7		8		6		5	50	

= 849

Argand Burners

卌.卌.卌.
卌.卌.卌 1

81

With Clear Glass Globes

6.1.8.0 = 15

Iris Shades

卌.卌.

10

With ground glass globes

16	1	7
12	6	6
2	4	
1	4	

59

opal globes

20	26	4
8	2	
1	8	
14	2	
	2	

= 87

8
26
1
12
6
6
12
6
6
3
6
20
4
15
16
12
6

10

252

165

8

Gas Jets without Globes

					25	4	10	1
12	25	12	4	2	23	30	12	24
20	7	12	20	8	10	16	10	6
14	2	4	1	2	9	6	2	6
6	8	8	20	4	9	25	4	1
14	1	8	20	2	12	4	2	6
4	6	8	4	10	1	26	2	
9	30	12	24	2		3	50	
7		8		6				

= 849

Argand Burners

81

With Clear Glass Globes

6.1.8.0 = 15

Iri Shades

10

With ground glass globes

16	1	7
12	6	6
2	4	
1	4	

59

opal globes

20	26	4
8	2	
1	8	
14	2	
	2	

= 87

Book 5

Bothered by Heat

Yes		No		
5	3	2	1	
1	1	2	1	
1	1	3	1	
3	1	2	5	
2	2	3	1	
3		3	2	
1		4	3	
2		1	1	
1		3	3	
3		1	1	
2		1	5	
2		3	3	
		1	2	
			4	
34			63	

55.75
17.00
52.50
11.75
54.00
4.92
49.50
15.50
25.83

59 | 286.75 | 4.86
236
507
472

28 | 117.56 | 4.19
112
55
28
276
252
14

Year

7.00
5.00
12.00

59

Book No 5.

For Jan, or Dec.	June, or July.			per Month	bills.
6.00	1.58	8.00	12.	1.75	286.75
7.50	.50	2.00	.50	1	4.19
2.00	1.20	4.00	10.	1	average for 59 bills
4.50	2.00	1.00		80	
11.00	2.00	1.00	4.00	3	
45.00	20.00	1.50	18.	1.00	4.92
3.80	1.24	8.00	4.00	2.50	
56.08	28.04	3.00	1.25	.50	
3.37	.20	3.00	2.00	6.00	
3.00	.50	2.00	6.00	1.50	
11.00	5.40	1.00	3.00	20.00	
7.00	5.00	4.00	3.00	5.00	
		4.00	3.00	2.00	
		3.00	9.00	15.00	
		4.00	35.00	2.00	
		5.40	2.00	2.50	
			2.50	3.00	
			4.00	1.00	
			2.00	3.00	
			1.50	2.00	
			36.00	2.00	
			1.25	23	
			1.00	5.00	
			8.00	15.00	
			7.00	1.50	
			5.00	.60	
			6.11	1.00	
			25.00	1.50	
			3.00	1.00	
			54.00	25.83	

5.00 1.00 54.75 7.00 52.50 11.75 15.50

157.25 | 67.66 | 49.90

67.66

13.10 average for Jan or Dec,

117.56

28 bills

4.19 average of 28 bills for June or July

Dont Denver tell what they pay
2 N. P.

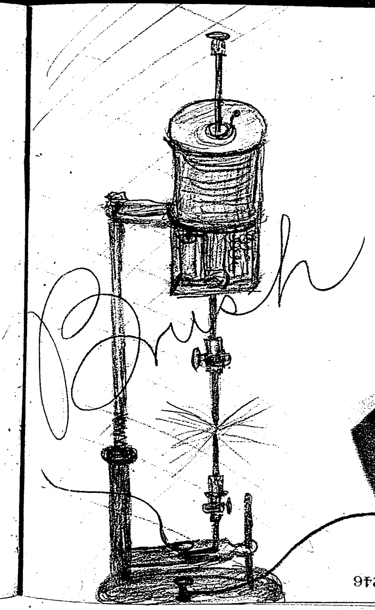
145
38 1/2

Book 4

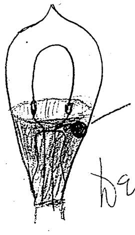
2 Horse Power.	1 Horse Power
55. per month.	4 " "
7 Horse Power.	2 " "
6 Horse Power.	
7 " "	2 " "
8 " "	4 " "
40 " "	4 " "
10 " "	2 " "
15 " "	
80 " " Reading Power	3 " "
2 1/2 " "	1 " "
1 " "	
2 " "	4 " "
5 " "	2 " "
4 " "	4 "
2 " "	10 " "
2 " "	50 " "
10 " "	2 " "
10 " "	4 " "
	40 "

10 Horse Power

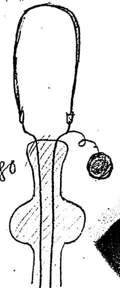
Edison Electric Light Co.
New York


Brush

Wm J. Hammer



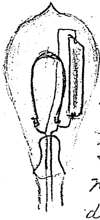
Dec 7-1880



Globe lined inside + coated outside with platinum foil the inside part having pith ball coated with platina on one wire which made contact with inside coating the other wire to be connected with outside coating

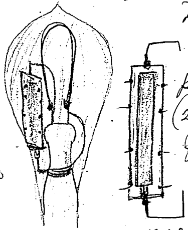
Made two of the plating on one twice the height of the other

Dec 1880



Condenser of tinfoil + mica several from 3 to 7 layers foil, fastened with shellac + gum tragicanth which volitalized + deposited on carbon changing resistance greatly

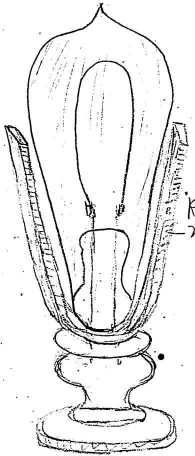
Dec 7-1880



In this used platina foil (2-of 5 + 6 sheets) fastened the mica plates together with .005 platina wire setting condenser further down + getting firmer clamping

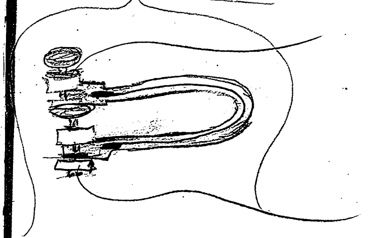
Wm H. Freeman

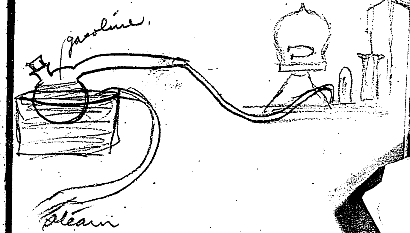
Nov 1880



Sg Wm J. Hammer

Dec 4-1880.



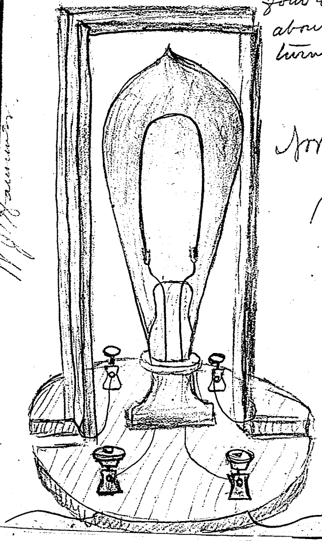


N J Hammer. Over

Coil of no 28 wire four layers about 150 turns,

Nov 25

1880



T

170,284 / 89607 0X / 156100

229,020) 93,899.00 (

170,680 / 91168 00 (5-3
85 340 0 0X
5 82 8 00
5 1 20 40
70,760

179,214 / 45 178 00 / 25
35 842 8X
9 33 5 20
8 96 0 70

170,680
5
853 4,00
170680
179214.00

~~179214.00~~ / 93 899 00

179,214 / 91168 00 (5-6
896070X
1156100
1075284
80816

137,970.00
46,802.00
$ 91,168 00 Net Income

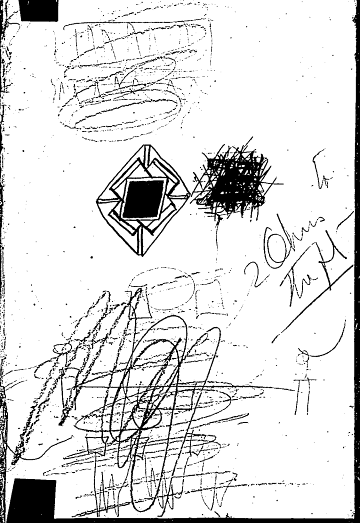
170,680.. / 91,168.00 / 5-3
85 340 0x
5828 00
51204 0
760

170,680.
.05
8534.00
170680
179214.00

7482.50
4000.00
8190.00
2190.50
7000.00
28863.00
7200
$ 3607[illegible]
10731.00
46,802.00

[illegible] 1880

47



Menlo Park Notebook #121 [N-80-10-15.1]

This notebook covers the period October 1880-February 1881. Most of the entries are by Francis Jehl. There are also a few entries by Francis Upton. All the entries relate to tests of lamps sent from the lamp factory to the laboratory. There is also a copy of a memorandum by Charles Batchelor regarding these lamps. The label on the front cover is marked "Lamps Lot 1," "16 C," and "Francis Jehl." The book contains 284 numbered pages.

Blank pages not filmed: 44-45, 112-115, 126-143, 168-279.

E. M. F. on Buck! ... 1400

230
2

3) 460
140

Eie7

C

R

195 − 194

16

37.650 + 300

200
Tested on Oct 22
at ten P.M.

195
194
3 | 389
129

1295
.189 R
36 ohm

37650
300
20 | 37950 (189

379
188
191

There Lamp was put
on at 10.20 Oct 15 1880

No 2

Eue 7	213 – 214
R	$\frac{37650 + 3100}{200}$
C	16

213
214
3)427
142

1420
203 R
17 ohm

37650
3100
20)40750
203

E117	222 - 221
R	$\frac{37650 + 9200}{200}$
C	16 147 / 234 R / ~~332~~

222
221
3)443
147

37650
9200
20)46850
234

went up about 9 oclock
oct 16 1880

No 4

Emit	189 − 186
R	$\frac{37650 + 300}{200}$
	125 C 189 R 440hms
C	16

189
186
3)375
125

37650
300
20)37950 (189
20
179
160
195
180

Rest Oct 20 1880
at ten oclock

Emf	203 - 203
R	$\frac{37650 + 3000}{200}$
C	16

1350
203 ohms
28 ohm

$$\begin{array}{r} 203 \\ 203 \\ \hline 3)\,406 \\ 135 \end{array} \qquad \begin{array}{r} 37650 \\ 3000 \\ \hline 20)\,40650 \\ 203 \end{array}$$

Denied on [illegible]
of Nov 1880

No 6

R $\frac{37650 + 8900}{200}$

Emf 222 - 222

C 16

~~18~~ 1480
232 R
17 ohm

$$\begin{array}{r} 222 \\ 3\overline{)444} \\ 148 \end{array} \qquad \begin{array}{r} 37650 \\ 8900 \\ \hline 20\overline{)46550} \\ 232 \end{array}$$

No 7

Em7	189–189
R	$\frac{37650 + 2700}{200}$
C	16

1265
201 ohms
44 ohms

$$\begin{array}{r} 189 \\ \times 2 \\ \hline 3\overline{)378} \\ 126 \end{array} \qquad \begin{array}{r} 37650 \\ 27 \\ \hline 20\overline{)40350} \\ 201 \end{array}$$

No 8

Emf	198 — 198
R	37650 + 3000
	~~7~~ 200
	1320
	203 Res
C	16
	33 R

198
2
3)396
132

37650
30
20)40650
203

No 9

E.M.F.	198 — 198
R	$\frac{37650 \times 1200}{200}$
C.	16 132 194 R 24 R

$$\begin{array}{r} 198 \\ 3\overline{)396} \\ 132 \end{array}$$

$$\begin{array}{r} 37650 \\ 12 \\ \hline 20\overline{)38850} \\ 194 \end{array}$$

No. 10

E.M.F.	230-232
R	to light
C	16 154 — R to light

230
232
3)462
154

went off about 9 oclock
oct 11 1880

No 11

Emf 198—198

R 37650 + 1200

200 1325

194R

C 16 24R

198 37650

2 12

3)396 20)38850

132 194

Busted at 2 oclock

Oct 18/890

No. 12

Em7 202 – 202

R $\frac{3700 + 37650}{200}$

C 16

1340
206 R
30

202
3
3(404
13420)41350
206

37650
3700

Burled at about 8 o'clock Sept Oct 20 1880

Em 7 2.05 — 205

R $\frac{37650 + 6100}{200}$

C 16

1365
218 R
28

205
2
~~100~~
3/4 16
13620 (43750
37650
61
218

No 14

Cut. 180 – 180

R $\frac{31400 + 3600}{200}$

C 16

1205
175 R
49 R

180
2
360

31400
36
1202) 35000
175

Busted at 8.45
Sat Oct 6 1880

15

Cut 220 — 220

R 37650 × 24500

200

C 16

146 S

210 R

11

220

3 | 440

146

37650

20 | 4215

210

went up at 7.45
oct 16 1880

No 16

Elect 215 — 213

R $\frac{37650 + 8800}{200}$

C 16

142 U
232 R
19 %

215
213
3(42820

37650
88
46450
142
232

No 17

EMF 213 - 213

Ro 37650 + 4200

200

C 16

1425
209R
17R

213
2
3)426
142

37650
42
20)41852
209

~~Broke~~ ~~Buttle [illegible]~~

~~[illegible]~~

Broke ~~of~~ about
five oclock
Oct 15 1880
J

No 18

EMF	189 – 189
Ro	37400
C	200 16

126 U
187 R
33 ohm

189
$\frac{378}{3} = 126$ $\frac{37400}{200} = 187$

~~15~~

Busted at half past one oct 20 1880

Cut	208 - 208
R	37650 + 5500 / 1380 / 20 — 215 R
C	16 — 25 R

208 × 2 = 416 / 3 → 138

37650 + 5500 = 43150 / 20 → 215

138) 156   215 × 154 = 860, 1075, 215

240 − 215 = 25

138) 33640 (240
276
580
552

Went up at 7:37 9 Oct 16/1880

E447 ~~2010~~ 210-210

R $\frac{37650 + 7500}{200}$ 220 lbs

C 16

37650
7500
20)45150
2257

210
2
3)420
140 : 154
225
770
308
308
14)34650 (247
28
66
56

went up of 9 p about 1.5
oct 16 1887

Eut 242–243

R $\frac{37650 + 25000}{2000}$

C 16

$$\begin{array}{r} 244 \\ 243 \\ \hline 3\,)\,487 \\ \hline 16 \end{array}$$

Rol no 2 Oct 18 – 1880

CMT	218 – 2.18
R	$\frac{37650 + 1200}{200}$
C	16

EMT 228 – 227

R $\frac{31400 + 44000}{2000}$

48

C Blue at the Camp

EMT 212 – 212

R $\frac{31400 + 6000}{200}$

C 16

Emf 240 — 240

Ro 37 650 + 4500

200

C 16

Blue at lamp

EMF	220 – 222
R	$\frac{31400}{200}$
C	48 Blue oil Clamp
EMF	190 – 190
R	$\frac{31400 + 1000}{200}$
C.	16 Blue oil Clamp

EM7
R
©

very high resistance

Em 7

238 – 240
to high resistance

7

Emt 208 – 208

R $\frac{37650 + \cancel{3}500}{200}$

C 16 Blue at the Clamp

Cu7 Hg in the globe
and Blue at the Clamp
195 – 198

R 31400 + 4500 / 2000

C 16

Emf $208 - 210$

R $\dfrac{37650 + 200}{200}$

C 16

Hg in the globe
Blue at the Clamps

10

Emt 215 ~ 217

R $\frac{37650 + 2000}{2000}$

© 16

Blue at the Clamps

Em7	212 – 215
R	$\frac{37650 + 1800}{2000}$
C	16

Blue at the Ramp

12

Emf 210 - 207

R $\frac{37650 + 2000}{2000}$

C 16
Blue at the Clamps

1-3

Ent	207 – 207
R	$\frac{37650 + 500}{200}$
C	16

Blue at the Clamp

Ein 7 222 - 222

R $\frac{37650 + 5700}{2000}$

C 16
Blue at the Clamp

15

Em4	211 — 212
R	$\frac{37650 + 4000}{2000}$
C	16

Hg in the glass and
Blue at the Damp

16

Cut 198 – 198

R $\frac{31400 + 21.00}{2000}$

C 16

Blue at Clamps

17

Em7	226-228
R	$\frac{37650+1500}{200}$
C	16

Blue at the Damp

EM7	200 - 200
R	$\frac{37650 + 2000}{200}$
C	16

Blue at the Clamp

Ent Hg in this globe
206-207

R $\frac{31400 + 5200}{200}$

© 16

Blue at the Clamp

Elu7	200 - 200
R	31400 5200 200
C	16 Blue at the Clamp

21

Em7 202 – 202

R $\frac{31400 + 45000}{2000}$

C ·16
Blue ai the Campus

Res $\frac{31400 + 300}{200}$ *

Emf 178 — 180

C 16

Ant 242 – 242

R To highresistance

C 16

Emt 179 – 179 *

R $\frac{31400 + 3000}{2000}$

C 16

25

Em7	218–218 *
R	$\frac{37650 + 8500}{2000}$
C	16

Emf 198 – 198

R $\frac{37650 + 2500}{2\text{ ---}}$

C 16

27

Cult 192 — 192

$\ell \quad \dfrac{37650 + 3500}{200}$

$\mathbb{C}$ 16

Ult	221-221
R	$\frac{34650+9000}{2000}$
C	16

29

Cut 205-206

R $\frac{37650 + 6200}{200}$

C 16

30

EMT	203-203
R	$\frac{37650 + 5000}{200}$
C	16

Oct 21

Ramps. Marked light vacuum was put on at 9.10.clock

Oct 23

Received from lamp factory
19 new bulb, new made
and iron clamps.
Same carbons as lot 2
2 ditto but nickle
clamps. 2 old style,
nickel clamps 1 sent
up before

Signed
Bachelor

Nov 3 1880.

147
2
294

150
2
3)300
100
100
10000
443
30000
40000
40000
130)443000(3407,
39
53
52
100
91

3407)33000(

8.8 oclock at 63.C

189 – 189

buoted at 8.37

was at 881

18870
5000
23870

80
68
12

12) 68 (5.6
5.6

200) 23870 (119

38
20
187
180
7

80
336
280
31.36
2
62.72

189
2
3) 378
126

119
52
7

119
714 5
714 5

119) 703310
59544
10663
952
11110
1071
300

(5892

5892) 33000 (5
29460
554

69.5
10.5

146 Volts

695
69.5
25

18870
5500
24370
121.85

1,8420
2
3,6840
2.0424
1.6424

0212
2
0424

44
2
88 candles

7922 ftlbs.

) 33000

45185
38955
.6197
1.9445
1.3842

4.2

367 per HP.

12500
3300

200) 15880
79

115
3) 230
76

76
76
456
532
5776
44.3
17328
23104
23104

79) 25487.68 (3226
237
178
158
207
158
4964
4745

188
188
322 sft

Lot 221 — 220

314
31
314
942
4

1760
3) 5280
3
123.20

Nov. 8 1880

{ 133 - 133

$$3\,\boxed{266}\;\;\begin{array}{l}133\\ 88\end{array}$$

$\frac{12580\ 1900}{200}$

C16

$$\begin{array}{r}12580\\ 1900\\ \hline 20)\ 14480\end{array}\ (9$$

$$20)\ 14480\ (72\text{ ohms}$$

This Lamp was coated at the clamps with carbon by being immersed in Kerosene..

$$72)\ 343060\ (4764$$
$$\begin{array}{r}288\\ \hline 550\\ 504\\ \hline 466\\ 432\\ \hline 340\\ 288\\ \hline\end{array}$$

$$4764)\ 33000\ (7$$
$$33348$$

5

18870
300
2)19170
110

6290
5100
2)11390
56.9
2)3980
19.9
6290
3400
2)9690
48.4

18870
400
2)19270
1270
20

96.6

6290
1400
2)7780
38.9

12580
2800
2)15380
76.9

15 12580
4800
2)17380
86.9

5950
29.7

12580
900
2)13480
67.4

96
87.
77
67.4
56.9
48.4
38.9
29.9
19.9

129 6
176

33 [illegible]

4.2210794
1.6464037
7.7544873

3.6219704 [illegible]
6.3780296
4.5185139

0.8965435

7.9 H.P.

113.
143

4.1061568
1.6464037
7.8446630

3.5972235

6.4027765
4.5185739

0.9213504

8.3 HP,

16

111 U
138 R

4.0906460
1.6464037
7.8601209

3.5971706

6.4028204
4.5185139

0.9213343

8.3 HP,

No 5: 139

Feb 8

Order 48 R 300
104 1/2 V. 4(B)

120.15 V

18840
4500 R

200 / 23340 / 116
1340
1200
140

116 ohms

130
116
780
130
130

120 / 15080 / 125
120
308
240
680
600
80

126
117
19 Ohms inserted.

Order 48 R 285
100 1/2 V 6

.120.15 V

18840 R
3800 R

200/22640/113
200
264
200
640
600
40

48 C

130
113
390
130
130

123
113
10 Ohms inserted.

120/14690/122
120
269
240
290
240
50

103 1/2 V or
7(A) 48 R 280

122.85 V

18840
3900 R

22740

48 C

200/22740/113
200
274
200
740
600
140

121
114
7 Ohms inserted.

130
114
520
130
130

123/14820/120
123
252
246
60

3.6521496
1.6464037
8.0969090

3.3954623

6.6045377
4.5185139

1.1230516 13.3 H.P.
at 16

3.5847834
1.6464037
8.0861861

3.3173732
6.6826268
4.5185139

1.2011407

15.82 H.P.

16.2.

3.5777502
1.6464037
8.0846002

3.3087541
6.6912459
4.5185139

1.2097598

16.20 HP.

9.9 1/2 U
14
order 48
R 275

116775

18840
3300 R

200/ 22140/110
200
2104
48 C
140
123
111
12 Ohms inserted.

130
111
130
130
130
117/14430/123
117
273
234
390
351
39

Feb 8 order 144 R 285

111½ 1 ✓

121.50 ✓

18840 R
5000

200/23840/119
200
384
200
48 C

119 1840
130 1800
3570 40

127
119
8 Ohms inserted.

119
122/15470/126
122
327
244
830
732
98

Order 144 R 330

6 114½ ✓

130 ✓

18840 R 48 C
7500
200/26340/131
634
600
340
200
140

130
132
260
390
130
130/17160/132
130
416
390
260
260

Feb. 8, 1881.
Order 144 - R 290
29

121.50 V

18840
4300 R
23140

48 C
200/23140/115
200
314
200
1140
1000
140

124
116
8 Ohms inserted.

130
116
780
130
130
122/15080/123
122
288
244
440
366
74

Feb. 8, 1881.
Order 144 - R 270
99 1/2 V - 26

114.75 V

18840 R
4000 R
200/22840/114
200
284
200
48 C
840
800
40

128
114
14 Ohms inserted

130
114
520
130
130
115/14820/128
115
332
230
920
920

Feb. 8, 1881.
Order 144-R295
111½ V-9

124.83 V

1884 0 R
59 00 R

24740

48 R

200/24740/123
200
474
400
740
600
140

130
124
520
260
130

125/16120/128
125
362
250
1120
1000
120

129
124
5 Ohms inserted

Feb. 8, 1881.
Order 144-R250
28

118.12 V

1884 0 R
43 00 R

200/23140/115
200
314

48 R
200
1140
1000
140
140

130
116
780
130
130

118/15080/127
118
328
236
920
826
94

128
116
12 Ohms inserted

Feb. 8, 1881.
Order 144 - R 230
4

118.12 √

18840 R
2700 R

200 / 21540 / 107
200

48 e

1540
1400
108 140
130
3240
108
118 / 14040 / 118
118
224
118
1660
944
116

119
108
11 Ohms inserted.

Feb. 8, 1881.
Order 144 - R 290
111 V - 18

124.83 √

18840
6200 R

200 / 25040 / 125
200
504
400
48 e

130
125
650
260
130
125 / 16250 / 130
125
375
375
0

1040
1000
40

130
125
5 Ohms inserted.

Feb. 8, 1881.
Order 144 – R 310
6

120 ✓

18840
5200 R
24040

48 C

200/24040/120
200
404
400
40

130
120
2600

130
130/1,5600/120
130
260
260
0

Feb. 8, 1881
Order 144 – R 260
22

118.12 ✓

18840
4500 R
200/23340/116
200
334
200
148 C

1340
1200
140

130
117
910
130.

129
117
12 Chusinertro.

130
118/15210/128
118
341
236
1050
944
106

Feb 8

112½ V

" or 144 R 240

122.83 V

18840
3300 R

22140

48
200/22140/110 R
200
214
200
140

117
111
6 Ohms inserted.

130
111
130
130
130
123/14430/117
123
213
123
900
861
39

or 144 R 270.

103½ V 27

118.12 V

18840
3800 R

22640

48
200/22640/113
200
264
200
640
600
40

125
113
12 Ohms inserted.

130
113
390
130
130
118/14690/124
118
289
236
530
472
58

Feb. 8, 1881.
Order 144
3

116/12 V

18840
5000 R

23840

48 C

200/23840/119
200
384
200
1840
1800
40

131
119
12 Ohms inserted.

130
119
1170
130
130
118/15470/131
118
367
354
130
118
12

Feb. 8, 1881.
144 - R 340
116 V - 15

130 V

25127
3700 R

28827

48 C

200/28827/144
200
882
800
827
800
27

130
144
520
520
130
130/18720/144
130
572
520
520
520

Feb. 8, 1881.
Order 144 - R 305
2

122185 ✓

18840 ✓
5600

200/24440/122
200
444
400
440
400
40

48 C

130
122
260
260
130
123/15860/128
123
356
246
1100
984
116

129
122
7 Ohms inserted.

Feb. 8, 1881.
Order 144 - R 225
106 V - 23

114175 ✓

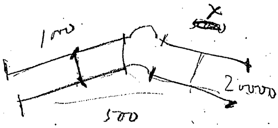
2800
18840 R

21640
48 C

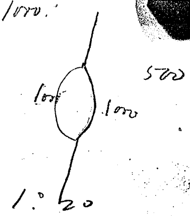
200/21640/108
200
1640
1600
40

122
108
14 Ohms inserted.

130
108
1040
130
115/14040/122
115
254
230
240
230
10



1000 ohms, | 1000, ohms



A9 1 : 20 1000

20 :: 1 :988

R : R' :: e' : c
1000 : 20000 :

$$\frac{x-3}{x+2} = \frac{1}{4}$$

$$\frac{4}{\cancel{4x+8}}$$

$$4x \cancel{-12 = x+2}$$

$$3\cancel{x}$$

$$\frac{x-3}{x+3} = \frac{1}{4}$$

$$4x - 12 = x + 3$$

$$3x \qquad 15 \qquad 5 \qquad 8$$

$$\frac{x-3}{x+3} = \frac{1}{4}$$

$$4x - 12 = x + 3$$

$$3x = 15$$

$$x = 5$$

$$\frac{5}{8}$$

$$\frac{-3x-6}{x} = 1/4$$

$$\cancel{1/4x + 3x = 6}$$

$$\frac{x-3}{x+3} = 1/4$$

$$1/4x + \frac{3}{4} = x - 3$$

$$5x = 15$$

$$5/4x = \frac{15}{4}$$

$$x = 3$$

Menlo Park Notebook #123 [N-80-08-17]

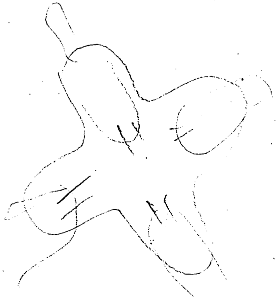
This notebook covers the period August 1880. Most of the entries are by William J. Hammer. There are also a few entries by Francis Jehl. The book contains notes, along with a few drawings, relating to tests of experimental lamps. The label on the front cover is marked "Hammer" and "Experimental Lamps." There is an index on the inside front cover. The book contains 284 numbered pages.

Blank pages not filmed: 26-35, 40-197, 200-269, 272-279.

Page	Lamp	Page	Lamp	Page	Lamp
1		13	803		
2					
3.	1421	13	Depot Lamps		
al 3 11	1424				
3	1382	13	748		
3	1427	13	420		
also 5 15	1384				
5	1395	13	311		
5	1428	15	484		
also 5 11	1380	15	468		
7	1360				
also 7 11	1435	15	1384		
7	1420	15	334		
7	1406				
		15	1331		
9	1433	17	1422		
9	1410				
		18	1445		
11	1424	19	1437		
also 3	1435				
also 7	1380				
also 5					
13	331				
13	802				
13	Lead glass no No				
13	176				
13	754				

1

Experimental Lamps
EDISONS LABORATORY.



"Experimental Lamps on Pump Line."

1421. 48 Candles, shunt of 11 ft - 22 Ohms,
Put up on pump line Aug 17-1880- 10.55 A.M
Carbon | slightly curved and clamped the new way flat side out - 4 hours 10 min.

1424. 48 Candles. Shunt of 10 ft - 20 Ohms,
Put up on pump line Aug 17-1880 at 11.00 A.M. Carbon nearly straight, was clamped the new way. Broke just above the shank at 3.30 P.M having lasted - 3 Hours 30 min - globe discolored

1382. 48 Candles, Shunt of 5 ft - 10 Ohms
Put on pump line Aug 17-1880, at 11.00 A.M, Carbon slightly curved | broke 3/4 ways up. was of old style clamping
Lasted = 1 Hour 45 min. - globe discolored

1427. 32 Candles, Shunt of 8 ft - 16 Ohms
Put on pump line Aug 17-1880, at 11.12 A.M. Carbon slightly bent | broke half way up Having lasted to 2.15 P.M
- - 2 Hours 13 min.

"Experimental Lamps on Pump Line"

1384. 48 Candles Shunt of 8 ft 1.6 Ohms.
Put on pump line Aug 17-1880, 11.05 A.M.
Carbon | bent considerably after being
up a couple of hours, was clamped
in the old way. taken down by order T.A.E.
to test 9.15 - lasted 8 Hours. 10 min

1395. 48 Candles, Shunt of 7 ft 14 Ohms
Put on pump line Aug 17-1880, at
11.05 A.M. | Carbon slightly bent, broke
half way up. Carbon clamped in the old
way, inside of globe quite discolored.
broke at 2.18 P.M. Having lasted 2 Hours 13 min

1428. 32 Candles, Shunt of 8 ft 16 Ohms
Put on pump line Aug 17-1880, at
11.10 A.M. Carbon slight bent both ways
| broke about half way up, was clamped
the new way, went out 3.10 P.M. Having
lasted 3 Hours.

1380. 32 Candles, Shunt of 10 ft
20 Ohms, Put on Pump Line Aug
17-1880 at 11.15 A.M. Carbon slighly bent
| was clamped in the old way, Carbon broke
just above shanks, Aug 18'80 at 8.10 Having lasted 11h-55 min
good vacuum

"Experimental Lamps on Pump Line".

1360. 32 Candles, Shunt of 1171-22 Ohms, Put on pump line Aug 17 at 11.15 A.M. Carbon curved much more after being up a couple of hours, in fact till it touched the glass making a blister and making the inside iridescent about 1.50 P.M. the carbon broke at point of contact and split nearly the way up. lasting 1 hour - 35 min.

1435. 32. Candles. Shunt of 1571-30 Ohms, Put on pump line Aug 17-80 at 11.30 A.M. Bulb made of German glass, Carbon perfectly straight clamped in new way, Carbon broke near shank, at 8 A.M. Aug 17- good vacuum lasted 11.30

1420. 32. Candles, Shunt of 1571-30 Ohms, Put on pump line Aug, 17-1880. at 11.30 A.M. There was a slight spot on carbon half way up at which point it broke at 2.50 P.M. Having lasted 2 Hours 20 min, new way of clamping.

1406. 32 Candles, Shunt of 1871-36 Ohms, Put on pump line Aug 17-1880. 11.30 A.M. Carbon clamped in old way. Broke, at 3.30 P.M I think there was an arc at clamp, glass was broken where the wire is sealed in, It lasted - 3 Hours.-

All these lamps had a poor vacuum F.A.E.

1433. 48 Candles. Shunt of 3.71=6 Ohms
Put on pump line Aug 17-1880, at 11.30 A.M. Carbon broke just above the shank, at 1.45 P.M. Having lasted 1 Hour 15 min, Clamped in the new way

1410. 32 Candles. No Shunt,
Put on pump line Aug 17-'80 at 11.37 A.M. Lamp burst at 11.48 A.M. having lasted but 11 min do not know which way carbon was clamped

1433

1433

Picking out the good lamps according to George

1424	48 Candles	210 minute
	48 candles	105 —
	48 candles still on	

this lamp was taken off by order of T.A.E.

133

448

112

1435	32 candles ~~still~~ on broke after	11.30
1380	32 candle still ~~on~~ " " "	11.55
	32 candles " "	180
	32 " "	

915

~~No 331 Gas street lamp~~

~~Fair vacuum~~

No 331 Fair vacuum {glass around the clamps

No 8 802 poor vacuum
(glass not around the wires.

Lead glass moderate vacuum
(glass not around the wires)

No 176 Fair vacuum
(glass around the wires

No 754 Fair vacuum!
(no glass around the wires

No 803 Fair vacuum
(glass not around the wires)

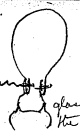
Depot lamp { very high vacuum
glass around the
platina wire

No 748 — Good vacuum
(glass not on wires

{ Lead glass very good vac,
No 420 white lead (glass around the wires)

No 311. good vacuum
glass around the wires

~~No 383 Poor vacuum.~~



484 { high vacuum
white lead glass.

468 . good vacuum
glass not around the wires.

1384. good vacuum
This lamp was taken off the pump line + broken to test by T.A.E.
No glass around the wires.

No 334 quite high ~~good~~ vacuum old lamp.
glass around the wires
thus burnt 14000 hours

No 1331 good vacuum.
taken from pump line.

No 1422 Hung on pump line
at 7.15 P. M. Aug 17-1880. carbon
broke near curve Aug 18-80 - 8.25. A. M.
having lasted $\frac{h}{6}$ - 10 min

Very high vacuum as it was
sealed off when the Engine stopped
for all night.

No 1445

20 = 32

Em 7.225

13 ft for 32 C

~~[illegible]~~

Good Carbon

put up on pump line.
7.40 P.M. Aug 18-80
The lamp arced at the
clamp, and broke
at 8.40 Having
lasted
1 Hour

The clamp was fused into
a pellet which dropped
down into the point of
the lamp shattering it
noticed a pellet of platina
on the shank of the
carbon which broke only on one side

No 1437

Carbon Slightly bent

It required five feet for
to make it 32 E.M.F.
~~Em 7 for~~ L. 227 R 225.

put on the pump-line
at 8.45. P.M., aug 18-80
this was not a bit blue at the
clamps. Went at 11.
Lasted ~~3.45~~

broke half way up the
side.

No: 1441

Marked Low Vacuum
Carbon bent, and
bright spot at one of
The clamps.
five feet to make it 32c

EM 7. 226 L. 227 R

This lamp broke at
clamp after being up
but a few minutes.
Aug. 18-80.

[illegible]

No 1442

Carbon Slightly bent
Wanted 15 ft for 32 C
228 L. 228 R.

Clamped the mean[?]
nys put on pump
line —

No 1443

Good Carbon.

Required 8 ft for 32 C

EMW 7. 229 R 229 L

Bad spot at the clamp

8 feet for 32

EMW 7. 230.

Carbon slightly bad

Clamped the new way

[illegible] on the pump

[illegible] —

No 1399

Carbon bent

It required 15 ft for 32 C

EMW (7) 229.

put up on pump [illegible]

— old way of clamping.

No 1396.—

Carbon broke half way up, ran abt about 1/2 hour

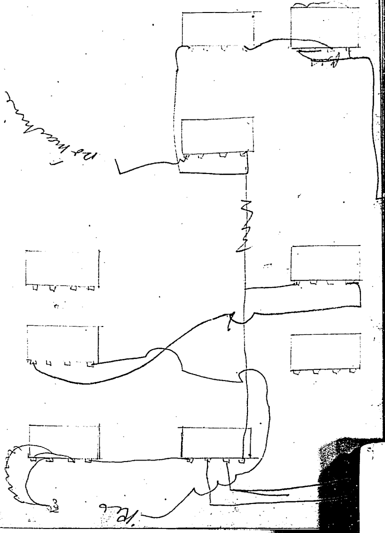
Noticed that almost all of these experimental lamps are considerably discolored on the inside even though up but a short time.

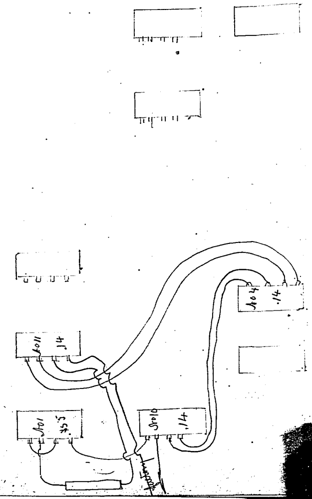
old way of pumping.

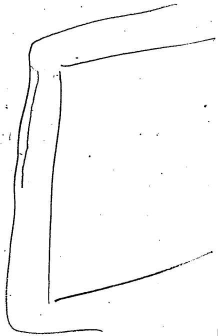
No 1446 —

Hung on pump line

Carbon nearly straight—







365,-
11
365,-
365,-
4015,-
20874,-

25
8.
200.
5
1000. 47. 2.

470
300
41 000.

14000

1000.
1400
10 100
20
1520

4 8

47
4
188 47- 1000.

47

8 80

$2\frac{1}{2}$

20.

40
10
400.

24.
300
7200

12
40
480.

300

30
20

1685
350
280
2315

2400

25
5
125
10
1250

1250
300
375,000
/200
187
5
935
750
1685

250
300
750,00

25.
1000
1200
500
2700

3000
3500,

Menlo Park Notebook #124 [N-80-11-18]

This notebook covers the period November-December 1880. Most of the entries are by Francis Jehl. A few entries appear to be by Francis Upton. The book contains notes and calculations relating to tests of experimental lamps. Included are tests of bamboo, bast, paper, and gasoline-treated carbons. The label on the front cover is marked "Lamps Lot D" and "Francis Jehl." There is an index on the inside front cover. The book contains 284 numbered pages.

Index.

197° – 198° = 16 candle

R 31406 + 5000 / 200 Nov 16

34°

10 35° = 34° C

264
54
320.

3 …
7 36 grms

348
35
.13

Index.

197° - 198° = 16 candle

R 31406 + 5000 / 200 Nov 16

34°

10.35° = 34° C = 93 1/5

10.48 50.3/4 C

vessel lamp + water 1056
vessel + lamp 261
lamp 59

261 − 59 = 320.

1056 − 320 = 736 grains

348 − 35 = .13

50.75
34

16.75 ¢

736 gm
15.43

13) 37717.65 (2901.3 ft
26
117
117
17
13
46
39

2901) 3990.0 (1.1
2901
9890

736
15.43

2208
2944
3680
736

7000) 11356.48 (1.62 lbs
7000
43564
42000
15648
14000

1.390
1.62

2780
8340
1390

2251.80
16.75

1125900
1576260
1576080
2251800

37717.6500

Jan 736


```
 197
 198
3|395
 132 V
 182 R
```

```
      31406
       5000
200)36406 (182
    200
     1640
     1600
      406
```

```
182)772020 (4
    748
```

```
        3
182)772020 (4241
    728
     440
     364
      762
      728
      340
```

Balling 32 — 32

Def 198 — 6 196 = 16 C

42.3

3 - 6 o'clock!
4.16
195 — 196

234
2

8 | 468
156.5

Time
(3.5 6') (1)
(4.1 6') (2)

Def 195 – 196

42.3 7°
92.1 7°
) Temp

weight with vessel + water

1286.5
417.5
869.0

Lamp 58
vessel 202 1/4

(156.5 fels)

52. C. 4.45 .5.15

14

17
6
3
4

$170 \overline{)1078091}$ 6335
102
58
51
60
51
99
43
85

3844.56
.191

384456
346010
3844566

20) 73481.046 (3471

3472

94
49
31
119

.0471) 39.239 (9.5.

17610

92.17
42.37

49.87
772
996
3486
3486

3844.506

8.69 grms
15.43

2607
3476
4245
869

7000) 13408.67 (1.91

64086
63000

108.60

.869
2.2

1738
1738

1.9118.

2) 4.98

2.49 per minute

1.91 0.2810
2.49 0.3962
775 2.8893

3.5665

3685

These figures were on cover of this book.

$$\frac{5}{9} + \frac{160}{9} = 34$$

$$\begin{array}{r} 34 \\ 9 \\ \hline 306 \\ 160 \\ \hline 5)466 \\ 93.5 \end{array}$$

180

170

Nov 18

(Lamp marked 3 hours but 217 (400)

179 - 179 EMF,

$$\begin{array}{r} 3)358 \\ \hline 119 \end{array}$$ V

25127

3400

20)28527 (142 Res

85

80

52

Hg in the Globe,

Put up at 3,40 Nov 1880

Lamp old style (now 240) *

207 – 207 EMF.

37687 + 700
700

20)38387 (191 Res.
20
183
180
3

207
2
3)414
138

No 16

Put up at half past two Nov 18/88

Nov 18

17

18

26.5

25

$380) 33000 (7.5
30660
23400
600

(Lamp 460 down to 222)

178 - 178 EMF *

2512
3500

20) 22627 (~~10~~ Res
20
162
160

178
3)356 2 2
118

(2.86
143 ohms

178
178
(356
119

143) 627330 (~~5~~4380
~~425~~
572
553
429
1240

Put up at 16 at 2.30. Nov 18 1880

218

204 — 209

37687 R
6200

$$\frac{.209}{3)418}$$
139

16

Lang marked (350 ohms)
old style 12 Bamboo 115 ohms

2) 43887 (219
40
35
35
188
180

135.63) 670210.00 (~~[illegible]~~ 4930

~~67815~~

54252

127670

123067

46230

4930) 33000 (6.6

29580

34200

17

~~47~~ 21

29

Nov 19

Lamp marked " Basic Plat

Clamp 5 hours Carbonization

Extra high heat. " " without C

but partial vac 314 with C

21.5 Pv. " " Previous 305"

185 - 185

25127 + 2000

16

25127

27127

135.63

185

185

370

123

190 - 190

25127 + 1700

Put on at 2:30 at 16 C

On Sunday Nov 20 1880 1 oclock

163) 616830 (4150
592
248
163
850

4150) 33000 (

Nov 19

"Blue on Plat wire" = Now after
2 hours 250" "Bast Plat Clamp
5 hours carbonization Extra lights
Heat "Prev over"] 3011

177 177

31406 + 1200

31406
1200
32606
163.

16 - 16

177
177
354
118

Put on at 2.30 at 16C

1032)395000(3820
3096
8540
8256
2840

3820)33000(8.6
30560
24400

143 - 144 Emf,
17560
[illegible]
2|19060
95.0 hms at 22 C

138 - 138
12570
6700
2|19260
96

48 candle for hour after spark went Res 170"
Bast - Plati clamps 5 hours carbonization Extra high heat "Res 250"

142 - 142
18840 + 1800
16

18840
1800
(2)42(?)
103.2 Ohms

142
142
3 | 284
94.6 Volts

Put on at 230 at 16 C
on Sunday measured again same EMF
gave 22 C

see page 55

1207) 460900 (3820
3621
9880
9648
2320

Nov 19

48 Candle for left 1 hour after spark went R 191
Base Plat Clamp 5 hours carbonization Extra high heat = Prev 285

16 C

153
153
306
102
18840
53000
24140
120.7

Put on at 2:30 at 16 C

117.45)469980(4000
46980
1800

4000)33000
8.25

Nov 19

186 ohms Cold
T.A.E 4 hour lamp
5 hour ordinary heat

18840
4650
2)23490
117.45

155
155
2)310
103

114 — 114 Nov 19/1880

12560
3000
2)15560
77.8

114
3)228
76.

3323.

77)25580
231
248
231
17

3323.

This land was put up at 16 at 3,20 Nov 19 1880

78
4
54

Sunday Nov 20 1887

Tested Lamp on page 29 of this book.

The lamp at 143 EMF, was 22 C, yesterday at same EMF it was 16 C.

151 - 151

18840
3700
2 | 22540
112.

3 | 302 (151 2)
100

16 C.

112) 443000 (3955.44 bat 16 C
336
1070
1008
620
560
600
560

18840
3400
2 | 22240
111.

3 | 314 (157 2)
104

22 C

111) 479150 (4318.44 lbs at 22 C
444
351
331
205
[illegible]
940

Sunday Nov 20 1880

Tested hang of page 27
of this book. at 10 C

18840
400
2 | 19240
96.

140
2
3 | 280
93

96) 383150 (3991 lbs
288
951
864
875
864
110

at .22 C

2 | 19040
95) 425460 (4475 lbs
380
454
380
740
685
550

148
2
3 | 296
98

4475) 33000 (7.3
31325
167[illegible]

3991) 33000 (8.5
28

3991) 33000 (8
31928
2072

18 3991
399

399) 2072 (
1995
0.77

Nov 21 1880

183 — 183

25127

16

Bad 5 hour
Reg vac process
1 hour no spark
Now 167
440 R Ro

183
3)366
122
125 R

5274.

2)25127
125.

125)65936.0 (5274,
625
343
256
936
876
610

This lot of lamps were
put up at 5.20. Nov
211 up to page 53

Ent 171 171

R, 18840 + 6000

16

(Bast 5 hours Reg v
Process 1 hour no spark)
191 Pres 508

$$\begin{array}{r} 18840 \\ 6000 \\ \hline 2\,)\,24840 \\ 124 \end{array}$$

$$\begin{array}{r} 171 \\ 3\,)\,342 \\ 1140 \\ 124\ R \end{array}$$

$$124)\ 57720\ (4642.$$

$$\begin{array}{r} 57720 \\ 496 \\ \hline 817 \\ 744 \\ \hline 532 \\ 496 \\ \hline 360 \\ 248 \end{array}$$

Nov 21 1880

163 — 163

18840 + 4700

1.6

Burst 5 hours
Reg & Process
1 hour no spark
184 Prev 543

168
2
3)326
108 0
127 R

18840
4700
2)28540
127

117)51672 0 (4416.
468
487
468
192
117
750
702

151 - 152
18840 + 4500
16

1 other high vac
spark gone
Process 491. now 182

151
152
3 | 303
101
116 Res

18840
4500
2 | 23340
1.1.6

1.16

116
8
28
44

4569 0 0
3484
1039
928
1110
1044
6 60
80

(~~4~~ 3895.

165 - 165

18840 + 8000

16

after hours. 2 parts gone

217 cold originally

455 ohms

165
2
3)330
1100
134 R

18840
8000
2)26840
134

134)5360 30 (4000.

030

3:

80
72
8)72(9
72

Nov 21 1880

153-153

18840 + 3600

16

Best 5 hours
by vac process
1 hr no spark
175 Prev 466

Put on at 81 C at 3.05 oclock
~~burst at 3.05~~

153-153
3|306
1020
109 Res

18840
3100
2|21940
109

109)460900)4228.
436
249
218
310
218
920

165 - 165

25127 + 400

16

Boat 5 hour

Reg process 1 hr no

Park 202

165
3)330
110
127 Reo

25127
400
2)25527
127R

[redacted] 127)53630 (4220
508
280
254
263
254
09

4220) 33000 (8.
33760

Lamp ~~lit~~ lamp on page 29
Page The same.
27 put on at 2 30 nov 19 1880

2.30 nov 19
12. nov 20 Sunday
Monday

)359900
355839

122.7) 356000 (2900
2454
11060
9802
1258

2900) 33000 (11.3
2900
4000
2900
11000

Gasoline carbon has been

15 candles

Batteries
33 R
31
64

135 L
135.5 R.
133
(2695
89.8 Volts
18840
5700
(24540
122.7

9638
9638
6464
9140
4880

3070

307

5185
4880
.0305

10.7 per H. P.

Gasoline

16 candles

137
139
276
92

18840

5550
24390
121.9

117.7) 555700.0 (4720
470808
8490
8239
251.0

4720) 33000 (7.
33040

48
7
336

Gasoline

48 candles

165
170
335
112
18840
4700
23540
117.7

127.2) 529000 (4160
5088
2020
1272
7480

4160) 33000 (8.

Regular Nov 23

16 candles No. 1

frosted

162.5
167
329 5
109.8

18840
6600
25440
127.2

95.2) 418.000 (43.90
3808
3720
2856
8640

4390) 33000 (7.5
30730
22760

Regular No 2

148
145
293
97.6

18840
200
19040
95.2 Ohms

119)4.72000 (4000
4768

4000) 33000 (8.25
32
10

Regular .017 X .010 Bursts

Nov. 23 Marked No. 3.

153
157
310
103.3

18840
5000
23840
119.2

151
155
306
102

18860
4100
22960
1.148

96.5) 457 (47.3
~~60~~
3866
7100
6755
3450

47.3
216
2838
473
946
102168

115) 462 (4010
460
200

Reg Bast

Exactly 16 candles $0''.010 \times 0''.017$

227 L
230 R
5(457
152

18860
4140
23000
115

531 2.7251
96.5 8.0155
1.3345
119 2.0751
2.0751
1.8464
7.9749
3.7715 5910
4.5185
.7470
5.58 1.6812
2.4282

268 candles per H.P.

Reg Bost
1510X017

48 candles

265
266
531

18840
2350
2) 21190
105.95

108
20
216 volts

96.5) 449.5 (465
386.0
6350
5790
5600

465
216
2790
465
930
100.440

~~484~~

111.3) 447000 (401.0
4452
1800

Reg. Bart
after 48 candles

16 candles

Batteries

222.5
227
449 5

47 R
49.5
96.5

1884.0
3420
222 6 0
111.3

Present reg. Bud 1.8 X 10.5

Old 17 X 8

28.5 : 25 :: 16 : 14.03

2041
3979
5452
1472

3740 3.5729
1.1461
2.4268
1.2041
3.6309

4270

~~336~~

96.5	1.9845
21.6	1.3345
	.6500

8
$3\frac{2}{3}$
$11\frac{2}{3}$

2.5263
.6500
1.8763
1.8763
1.6464
8.1175
3.5165

3280

Old paper loops very much bent

8 candles broadside edge
$3\frac{2}{3}$ "

170 L
167
168 R
336

Battery
47 R
49.5 L
96.5

12560
2700
15260
.7630 Ohms

2,5635
6500

1.9135
1.9135
1.6464
8.1302

3.6036

4010) 33

8.2

Old paper same as page 79

16 candles

185 L
181 R
366

12560
2270
14830

74.15

2.6395
.6500
1.9895 9.76612
1.9895
1.6464
8.1530
3.7784

6000 | 33~~00~~
5.5

.7404
1.6812
2.4216

264 candles per H.P.

old paper

48 candles Flashing blue in globe

217 L
219 R 6
3 | 436
19

12.560
.1500
14060
70.30

50 minutes

at 5-5

6-30 taken off

Bamboo Hinge Vac

18 candles

270
270

25127
3950
29077
145.38

31406
3950
~~27456~~
35356
176.78

2.6681659

117/177

2.7218 4.1663718
.6500 1.4
2.7.0
2.0718
2.0718 117 Volts
1.16464
~~7.8368~~ 136858
~~3.6268~~ 4230
7.757.82 13689.
~~3.667.2~~ ~~3690~~
~~4.51 865~~
~~.9513~~ 1180

~~8.94~~

3:5420 3480
4.51.85
:9765 9.47 per H.P.

Regular Bamboo

16 candles

265 L 47 R
262 R
527

~~25.27~~ 117 : 4.
~~4000~~ 177
819
~~24.27~~ 117
~~145.63~~ 11.7
13689

31406
4000
135466
17703

~~2.7340~~ 2.6454
~~.6500~~ .6500

1.9954
1.9954
1.6464
7.9056

3.5428

99

3490

[illegible]
16 to 17 candles

222 L
220
~~542~~
442

18840
6020
24860
124.3

2.4150
6500
1.7650
1.7650
1.6464
7.6055
2.7819

605 ft lbs.

Ramtos .050
6.
.30
.24

Lamp visible ~~yellow~~ red

132 L
128
260

37687
11900
(49587
247.935

Pt. clamp 5/8 long 1/16 125

.62
.16
362
62
.0982

.040 thick
4
.160
.62
.2
.120

.0625
2
.125
8
.1205

162 162

$$\begin{array}{r} 162\tfrac{2}{2} \\ 3\,)\overline{324} \\ 108\ \text{U} \end{array}$$

25127 3400

16

$$\begin{array}{r} 25127 \\ 3400 \\ \hline 627 \end{array}$$

52
$2\,)\overline{28527}$
142 R

142) 516720 (3638 F.P.
426
907
852
552
426
51260

3638) 33000 (9.7 H.P.
32742
2580

Burned for 3 hour at about 70 C.

67.75 inch

68.25

11.75

1.8340
2
3.6680
2.1422
1.5258
3010
1.8268

1.0711
2
2.1422

1.0682
19
1.0701
2
2.1402

67.

3.6682
2.1402
5280
3010
8290

67.4 candles

Nov 1880

194 = 194

132
5
660

194
194
3 | 388
129 V

25127 + 1300

132
8
1056

25127
1300
2 | 26427
132 R

132) 737200 (5584
660
772
660
1120
1056
640

5584 ft lbs

5584) 33000 (5.9
504

62
5.9
558
310
3658

18.2
21.6

~~2.0128~~
~~1.3284~~
~~.6844~~

2.0531
1.3284
.7247
6844
.0403
2
.0806

593.

2.7731
.6844
2.0887
2.0887
1.6464
7.8630
3.6868
.0806
3.6062

~~4000~~ ft lbs
4040

Lamp 15 D
Bast 17 X 10 | 5 hours carbonization
16 candles

295 L.
298
593

25,127
2300
27427
137.13

Batteries ~~5~~ 58 R
55 L
103

2.7050
.6844

2.0206
2.0206
1.6464
7.9998

3.6874 ~~4660~~
.0806

3.6068 4050 ft lb

Lamp 16 D

10X16 Burst Reg
16 candles :

250
257 R

507

18840
270

20010
100.05

2.7316
.6844
2.0472
2.0472
1.6464
7.9176
3.6584 ~~4550~~
.0806
3.5778 3780
.5185
9407 8.72

Lamp 17 D

16 candles

265
274
539

18840
3350
22190
1 80.95

2.7324
.6844
2.0440
2.0480
1.6464
7.9521
3.6945 ~~4 70~~
.0806
3.6139 4110.
.5155
9046 8.03

Lamp 18 D
10 X 14 Bast

266
274
540

18840
3500
22340
111.7

2.8267
.7247
2.1020
2.0020
1.6464
7.9200
3.7864
.5185
7381

126 Volts

6030

5.46

Lamp 190

10X17 Bush Bad Spot in it

16 candles Blue at clamps

333 L
338 R
671

18840
46.50
123490
117.45

1.7364
.7247

1.0117
1.0117
1.6464
7.9570

1.6268 4230
.5185

8907 7.77

Lamps 20

10X17 Bast

16 candles

271 L

274-275

545

18840
3400

2240

111.2

2.8182
.7247
2.0935
2.0935
1.6464
7,9487
3.7821
.6185
.7364
2041
9405

6050

5.45 lamps per H.P.

87.4 candles per H.P

Lamp 21

10 X 17 lash

15 Candles

328
330
658

18840
3650
22490
112.45

2.7709
.7247
0462
0462
6464
9052
6440

4400

5188
6440
$705

~~57~~
7.42

Lamp 22

16 candles

295 L
295 R
590

18840
6000
24880
124.4

busted on Nov. 28 1880 at about
[illegible]. Adler.

.7076
7247

.9828
9829
6464
9676

5798 3800 ft
5185

9387 8.68 per H.P.
2041

1428 139 candles per H.P.

4.2608978
1.6464037
7.9706162

4.0779177

1196.51

Lamp 23

253 L 16 candles
257

3)510
170

170
170

11900
170

28900
14413

86700
115600
1156

18.840
2700

21540
10707 Q

107)128027.0(1191
107

210
107

1030
963

670
42

5 1/2 Webers ~~times~~ the current required on Maxim

~~3/4~~ $4/3 \times$

$$\begin{array}{r} 5.5 \\ 4 \\ \hline 22.6 \end{array}$$

7.3 times the current

134 candles per H.P.

12 candles

$$\begin{array}{r} 16 \\ 9.5 \\ \hline 80 \\ 144 \\ \hline 156. \end{array}$$

$$71.\,lbs. = c^2 R$$

$$\frac{71.\,lbs.}{R} = c^2$$

$$R = \frac{71\,lbs.}{c^2}$$

$$\frac{1}{7.3}$$

.8633
.4316

.5684

2.2430
5684

1.6746

47 Ohms

Dec 6 1880

11^{D} up to Dec 6. 6 PM. 139 hours th Busted on Dec 8 1880

17^{D} " " Ditto lasted 178

16^{D} Ditto busted on Dec 18 1880

Reg No 6 241 hours

Nov 25 1880
11.25 P.M.

15^{D} Nov 28 at 10 am

16^{D}

17^{D} busted at 4 PM Dec 8

18^{D} 6

20^{D} 5 PM. 28 Nov 1880

22^{D} busted on Nov 28 at 10 am 1880

23^{D} busted at 5 PM Nov 28

$$\begin{array}{r} 139 \\ 32 \\ \hline 171 \end{array}$$

79.8) 199.5000 (2 510
1596
3990
3900
900

2510) 33000 (13 ~~per~~ H. P.
2510
7900

1.8260748
2
3.6521496

13
16
78
13
20.8 candles per H.P.

6 - 6
7 15
8 12
67

6
16.5
5.5
280

Half length Bamboo
3"

16 candles Batteries
32 L
32 R

100 L
102 R

3202
67
67.3

1.2560
3400
15960
79.8 Ohms

Put on at 16 C at 11 am
~~Dec~~ 3 1880
Dec 3. 14 hours Black on the globe
up to Dec 6. 6 PM. 37 hours
28
Busted at Dec 8. at 75 hours
1 AM.

82.3) 164950 (2000
1646
350

216
217
433

184.5 : 433 :: 82.3 : 193
82.3
1107

2.63649
1.91940
7.73401
2.28590

4000) 33000 (8.25 per H. P. of 17 candles
32000
1000

2012) 33000 (16.4
2012
12880
12072
7080

Half length carbon

8 1/2 candles

91.5 L

93 R
184.5
61.5

15960
500
16460

61
61
61
366
3721
443
11163
14884
82.3 14884

82) 1648403 (2013
164
84
82
203

143.13
~~109~~) 52633000 (0367
42939
96940
85878
110620

3690) 33000 (

0374
0374
6464
8447

5659
5165
9516

3680

8.9

Regular No. 1.

Dec 3 1880

32.5 R
31.5 L

162 L
165 R
327
109 25127
3500
28.627
143.13 Ohm

143 : 109 :: 143 : 143+X

109 : 143 :: 143 : 143+X

$$15042 \overline{)53003000}\left(3520\right.$$

45126

78770

75216

3560

$$3520 \overline{)33000}\left(9.3\right.$$ per H.P

31680

13200

214

2

3)428

142

.0434

0434

6464

8225

5557 3600

Regular No. 2

Dec. 3. 1880

165 L

167 R

332

110.6

25127

5000

30127

15042

181.5 | 866280 (4780
7260
14228
12705
15230

No 4 Regular

11 candles

210 L

31406
4900
36306
181.53

169) 744000 (4400
676
680
676

No. 3 Regular

Dec 3 1880
16 candles
194 L
195 R
389
129.6

31406
2400
33806
169.03

1205

178 Rs

2.0791812
2

4.1583624
2.2504200

1.9079424
1.6464037

3.5543461

35838

120
120

2400
120

14400
443

43200
57600
5760

178)6379200(3583
534

1039
890

1492

x y z

x y z

$9(x+y)$

$7(y+z)$

$8x-8y=x+y$

3 4 . 4 4

$368 \overline{)198054}$

1465

$$
\begin{array}{r}
2304 \\
86 \\
\hline
13824 \\
18423 \\
\hline
198054
\end{array}
$$

$$\frac{58}{406}$$

$9x + 9y = 7y + 7z \quad = 9x + 2y - 7z = 0$

$8x - 8y = x + z \quad 7x - 8y - z = 0$

$x + y + z = 1152 \quad x + y + z = 1152$

$$
\begin{array}{l}
9x + 2y - 7z = 0 \\
\hline
72x + 16y - 56z = 0 \\
14x - 16y - 2z = 0 \\
\hline
86x - 58z = 0 \ (1)
\end{array}
$$

$$\frac{86 \cdot 9}{774}$$

$$
\begin{array}{l}
9x + 2y - 7z = 0 \\
2x + 2y + 2z = 2304 \\
\hline
7x - 9z = -2304 \\
86x - 58z = 0 \\
\hline
\end{array}
$$

$\cancel{7(86x\ x)}$

$7(86x) - 774z = -198054$

$86(7x) - 406z = 0$

$80 \quad 368z - 198054$

16273
436

38
9

9541
9463
9541 8
9463 8
9 78
24

4.2114676
~~2.6344865~~
310
6.85.09541
24
18

7095(028)1

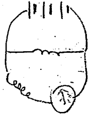
10

7095028
50
7095028

$\mathcal{E} =$

$\mathcal{C} =$

$$\mathcal{C} = \frac{\mathcal{E}}{r + \frac{S(P+g)}{S+(P+g)}}$$



S P+g

Batt Res = $r = R - (2P + \text{gal})$

$r = R - (2P + \text{gal})$

$2 \cdot R = 2P + g$

$g = 2P - R$

$g = R - 2P$

$$\frac{R_1R_2}{R^2} \quad R_1R_2\,R^2 \quad \frac{\cancel{R_1}R_2}{\cancel{R_1}} + \frac{R_1\cancel{R_2}}{\cancel{R^2}}$$

$r = R - (2P+g)$

$35 - 7$

Marion

600

$\frac{150}{600} = \frac{40}{20}\,2$

Sara Sarah Marion

	126	2.1004
	~~63~~	
comp	40	8.3978
Comp	1.08	9.9666
		0.4648

2.92 to a Volt

2.5539
~~.4668~~
2.0891 122.6 Volts
2.0891
1.6464
7.7764
3.6010 6010
.5185
.9175 8.23 per H.P.

Lamp No. 5

Dec. 13, 1880.

40 cells

~~6155 L~~
~~697~~
65
61
~~8126~~
~~63~~

16 C

177 L
181 R
358

25127
8350
33477
167.38

5752
4648
.1104

129 Volts

Lamps No. 6 reg.
Dec. 13, 1880.

16 c

185 L
195 R
188 L 17c.

185
191
374

31406
4800
3 | 35206
176.03

324

5105
4648
.0457 111 Volts
0457
6464
8477 3850
5855
5185
9330 8.57 per lamp

Lamps No. 7 reg.

160 L
164 R
324

3.24

25127
3300
28427
142.13 Ohms

5250
4648
0602
0602
6464
8265
5933
5~~4~~88
925 2

115

3930

8.42 per HP.

Lamp No. 8 reg

165 L
170 R
335

25127
4700
129827
149.13 Ohms

5185
4648
0537   113.2

Lamp No. 9

162 L
168 R
330

25127
3400
28527
142.6

Lamp No 10

159
164
323

2512
2?00
27127
135.6

Lamp No. 11

285 L
247 R

31406
3600

Lamps No 12

25 v. L

25127
3600

368 5658
3978
9665
9302 8.51

3464
9302
4162 26.1
4162
6464
5031
9819 959
5188
5366 34.4 per H.P.

1/4 length lamp

4 ~ G Dec 15
1880

110 L
112 R
3222

16279
31.38

Went up after
burning 2.42 hours
at Q4 @

4232
930

4930
4930
6464
530

1626
5188

3559

11450

22.7
/8

181.6

1/3 length way

8 Candles

131 f
134 R

265

5900

295

45 18
9302
5216

5216
6464
5376
2272
5185
2913
0792
3705

16.80 ~~[illegible]~~

19.5

234. candles per H.P.

1/34 lengths reg

12 o

140 L
143 R
28.3

5800
29.

4698
9302

5396
5096
6464
5427

2683 1850

5165

2502
2041

4543 284

1/4 length ring

16 Candles

145 L
150 R

295

15730
28.65

13871
9302
4569 28.6
4569
6464
4034
9636
4187
5449 35.1

1/3 length

Dec 15 1880

5 1/3 candles

152 L
155 R
307

6279
1620
7899
39.49

at 24 C. at 8.55 PM
finished at 1.30 PM Dec
16 1880 : 16.5 hours

5302
9302
6000
6000
6464
4187
2653 1840
5185
2532 17.9

1/3 length [illegible]

10⅓ candles

167 h
172 R
339

6279
1350
7629
3.8.14

5399
9302
6297
6297
6464
4283
3341
5185
1844

$\frac{U^2 \times 4.13}{R}$

15.3 per H.P.

1753 ft lbs.

1714) 33000 (1.
1714

4.1655708
1.6464037
8.4317983
4.2437728
5.7562272
4.5185139
0.2747411

1818 H.P.

1/3 length ring

16 candles
very ~~bi~~ [illegible]

179 L
184 R
363
121

40 cells

187 R
181 L
368

6279
1180
7459
3702

3.165708
64640

~~40~~ cell = $\frac{64 \quad 64}{1\cancel{50} \quad \cancel{150}}$

lamp 20 14

$$\begin{array}{r} 64 \\ 64 \\ \hline 128 \end{array}$$

185 = 185

$$\begin{array}{r} 31406 \\ 17000 \\ \hline 33106 \end{array}$$

166. Ohms

16 C

8.2 ~~per~~ H.P.

Lamp 15

~~went~~ I put it in

the Phon room and

an arc spring

and it went.

Lap 16

167 – 167

25127 + 2500

16 C

$$\begin{array}{r} 167 \\ 167 \\ \hline 334 \\ 111.3 \end{array}$$

$$\begin{array}{r} 25127 \\ \hline 27627 \\ 138.1 \end{array}$$

8.3 per ~~H.P.~~

Lap 17

165 – 165

25127 + 3500

16 C

$$\begin{array}{r} 25127 \\ \hline 28627 \\ 143.13 \end{array}$$

$$\begin{array}{r} 165 \\ 165 \\ \hline 330 \end{array}$$

11.0

$$\begin{array}{r} 0414 \\ 0414 \\ 6464 \\ 8447 \\ \hline 5739 \\ 5185 \\ \hline \cancel{9846} \\ 9346 \end{array}$$

3750

~~3330~~

~~3960~~

8.4

Lap 18

165 — 165

25127
2000
27127

16

165
165
330
110

135.1

6414
0414
6464
8697
5989
5185
9396

3970

8.67

Lap 19

158 — 158

2100
25127
27227
1360

16

158
158
316
105

8.9 ~~[illegible]~~ H.P.

Lamp 20

173 — 173

25127
5800

30927
15463 ohms

16 C

Lamp 21

176 — 176

31406
157 ohms

16 C

22

165 — 165

25127
4100
(29227
146.1 Ohms

16 (C)

23

164 — 164

25127
1100
26927 134.6 Ohms

16 (C)

24

165 – 165

25127
2000

16e

25

167 – 168

25127
1700

16e

26

176 – 176

25127
4800

16

27

162 – 163

25127
1700

16

28

178 - 178

25127
4700

16 P

29

Bad vac.
went up.

30

17.8 — 178

$$\frac{31406}{157.\ \text{Ohms}}$$

178
178
356
119 Volts

16

8.2 per H.P.

31

168 — 168

168
168
336
11.2 Volts

25127
2000
28127
1406 Ohms

8.4 per H.P.

32

165 — 165

165
2
3)330
110

18840
5500

64)165 (2.5
128
370
320

43.2
2.5
2115
864
10575

16

432 : 64 :: x : 168
432
336
504
672
64)72576 (1134
64
85
64
217
192
256

83

168 — 168

25127
3500

~~60627~~

16

3

64)168 (2.6
128
400
384

43.2
2.6
2592
864
11232

128627
143

1.08
40
4320

2)84
2)128
42

112 V
143 R

158 — 185
138
27
1
28

158
.158
316
105. Volts

106 Volts

130 Ohms
160

.0253
.0253
.6464
.8861

6970
1139
.5831

30 .5831
34
31 5797
33
132 5764
33
133 5731

3830

3800

3770

3740

133 5731	3740
32	
134 5699	3710
32	3690
135 5667	
32	3660
136 5635	
31	3645
137 5604	
31	3610
138 5573	
31	
139 5542	
31	
140 5511	
141 30	
5481	
142 30	
5451	
143 30	
5421	
144 30	
5381	

6970
146 1644
5326
30
6

6970
1614
145 5356 3430
30
146 5326 . 3400
29
147 5297
29
148 5267
29
149 5238
29
150 5209
29
151. 5270

6970
1818
152 5152
29
153 5123

150 - 150

18840
2700

16

150 - 150

18840
2700

16

36

154 – 155

18840
3300

16 ©

37

160. – 159

25127

16 ©

38

150 – 150
18840
4500

16e

2)23340
116

177 – 177
25727.
16e

40

165 – 165

25127
2000

16 C

41

150 – 150

18840
2300

16 C

42

156 - 156

25127

16 C

43

150 - 150 ✓

18840
4600

---

16 C

44

172 - 172

25127
3800

16 C

45

149 - 157

18840
3000

16 C

46

192 - 192

25127
6500

16

149 - 149

48

163–165

25127 + 2500

16 ℓ

49

149–149

2500

16 ℓ

150 - 153
25727
900

16 C

178 - 178

52

155 - 155

155 - 155

25127
2000

16

54

~~156 – 156~~

168–168

25127
4550

16 C

55

155 – 155

177 — 172,

170 — 170

58

158 – 158

59

152 – 152

60

192. — 193

61

158 — 158

165—165

25127
2700

16

165
2
3)330
110.

2000 : 100 : ~~215000~~
75

~~2400~~

2400 :

157 — 157

18840 1.L
3200

16 422240
1 i 1

2000 : 100 : 1980

~~2000~~) 198~~000~~
99

~~2000~~ : 1000 ; 1800

2) 19~~0000~~
95

2) 18~~000~~
90

1

64

164—164

65

166—166

66 a

157 - 157

67 a

Went up

68a

~~174 17~~

146-146

69a

174-174

70 a

170 – 170

71 a

153 – 153

72 a

165 – 165

158 – 158

74 a

200,200

75 a

170-179

76a

155-155

77a

164-164

78 a

166 — 166

188 - 188

80 a

150-150

81 a

153-153

82 a

190—190

83 a

153-153

84 a

166 — 166

85 a

158 - 158

86 a

195 – 195

160 – 160

88 a

150 – 150

89 a

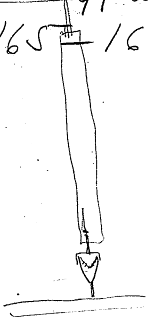
168 – 168

90 a

177–177

91 a

165 — 165



92 a

160 — 160

93 a

~~164 — 164~~

162 — 162

94a

1760 — 1760

95a

175 — 175

96 a

~~106~~

~~165 – 165~~

163 – 163

97 a

183 – 183

98 a

165-165

99 a

176-176

100 a

175 - 175

101 a

172 — 172

102 a

177-177

103 a

173-173

104 a

173–173

Clamp Split

105 a

173–173

106 a

165-165

107 a

175-175

108a

106—106

109a

159-157

$c = \frac{E}{R}$

~~CR~~

$C = \frac{E}{R}$

$E = CR$

$R = \frac{E}{C}$

1 Marion

2

B 2

M M

m Man

110 a

175–175

111 a

174–174

112^a

178-178

$$\begin{array}{r} 178 \\ 3 \overline{)356} \\ 118. \end{array}$$

113^a

180—180

114^a

166—166.

115^a

~~188—188~~ 1

170 —170 2

116

gest

169 — 169

615

1660 1880

1.45

1

1/4

1.45 . W

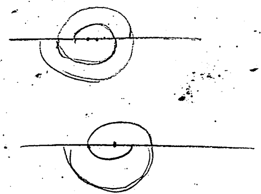
98 U a

Ro . . 6 a

117 a

169 — 169,

118



60
67

13)67(5.1
65
2

5.1
5.1
2

5.1
5.1

25.51
5
26.01
2
52.02

2(4

133

Menlo Park Notebook #125 [N-80-11-16]

This notebook covers the period November-December 1880. The entries are by Edison, Albert B. Herrick, Charles Batchelor, and Francis Upton. The drawings by Edison relate to lamp experiments designed to prevent the "carrying of carbon by electricity." These experiments led to the discovery of the "Edison effect." The notes and drawings by Herrick, which comprise most of the book, concern experiments to chemically treat carbons, to improve vacuums, and to devise a better method of clamping carbons to the lead wires. The notes and drawings by Batchelor deal with improved vacuum pumps. The calculations, notes, and drawings by Upton pertain to conductors and to experiments in electricity and magnetism. The book contains 282 numbered pages.

Blank pages not filmed: 84-91, 160-161, 164-265, 268-281.

Missing page numbers: 127-128.

N-801116

Nov 16 1880

Bast fiber:

First Experiment— 102

soak the fiber in Sulphuric acid as y[illegible] parch-
ment paper [illegible] wash
clean with slightly ammonia-
ted water

two lots of the above are
soaking 1 hours and 2 hours
in sulphuric @ 1.842 sp.
gr.

---

for Edisons Experiment in dipping
Bast fiber in sulphuric acid
unknown sp. gr. time

N-801116

These experiments No 2 & 3 were no good fibe lost all its stability and decomposed loosing the fibre completely

Experiment in test tube No 2 consists of five pieces of fiber 2 large 2 small 1 medium in Sulphuric acid of 1.542 Started at 5 on dial [illegible] soak tile & again ~~treated~~ one piece from test tube at 35 minutes washed in ammoniated water

No 2 Exp fiber digested and no good the notice that the coloring matter is more evenly distributed in No 2 than No 3 Sulphuric the same

Both these testubes filled
with ~~alcoholl~~ alcohol
and bast-fiber dipped.
Therein no 4 allowed to stand
(20 minute No 5 allowed ~~1 hour~~
~~5.20 both started~~
8 hours no precipitable
change in the color
of alcohol still remaining
in 4 hours no change
no change by night.

In test tube No. 3 same
as No 2 but to soak 2 hours
Sulphuric acid 1.8425 sp. gr
In testing sp. gr of this acid
and the hydrometer only
went as far as 1.8000
my results are not perfectly
reliable as regards sp. gr.

1 part Hydrochloric acid diluted
in 5 parts of water
fiber immersed and
remain from 5 min
Bcid - Cold
No X V 8 no change
over night in contact
of Hydrochloric

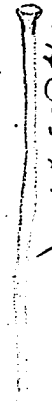
No 7

Hydrofluoric acid diluted
~~No~~ + 5 times it requires
volume

~~Not tried~~ Don't Use

Tried with several fibers
over 5 times its bulk in
water time 1/2 hour
action not very violent
but modified by the silicon
in the fiber, Bast

2 hours same
The fibers were lighter
than by the action of
any other acids



Hydrochloric acid 1 to 5 of H_2O ~

Bundle the fibers rather tightly and insert in tube (swell by soaking) be careful in packing tube length - the longer the tube better 8 feet - 1/2 in pipe 1 cm in weights.

2

2)196
42
2

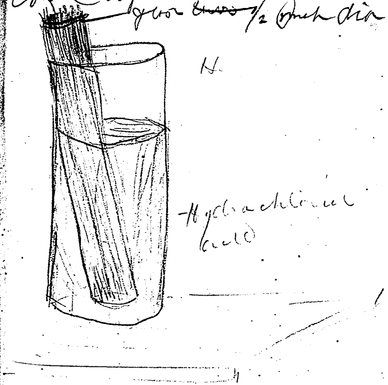
16)96
16
50

1 3/4 lbs or cut in

Cube residue for testing

- fibers advantages of Hydrochloric ~~is that~~ it attack minor metals and leave less of a residue

Heated the fibers to
make them smell more
in the tube before putting
them under pressure



Ex No 6 Dipped fibers in
Hydriodoric acid ~~and~~ working
by capalarity sucking the
acid through them
Hydrodoric diluted ~~16~~ 1/1 times
8

Put in tube No 5. some leaves for chlorophyl on two Bast-fibers Nov. 17

Also soaking some fibers in alum water and as soon as soaked thoroughly will dip in sulphuric acid

---

Regularly parchmentized ~~[illegible]~~ paper some fiber gave fair results but the action only was on the surface of the fiber any next experiment will tend to act on all parts of the fiber by capillarity and presence of the fluid

Got a ~~piece~~ pithy piece
of Beet and ~~...~~ can
see ~~the pith~~ and pith hole
...rsley will see if the
acid (Sul.) will act on
that ~~differently~~ than
~~the body of the fiber~~
Result was that small white
crystals formed on the surface
of the carbon especially where
cut before heating with Sulphuric
and ammonia water

crystalized is

Another experiment
conducted as the
above

Alum one

Amonia ~~Hydrate~~ = Sulfonine

Dog

[redacted]

29 2

Black to the eye if electricity microscope

is increased after sheep

feet to the eye and microscope

with cannot [redacted] have been

stopped [redacted]

Acetic acid — has same white

crystals as in sulphur quinine

but not as pepper as I used

by ~~a~~ comparative ex-

amination

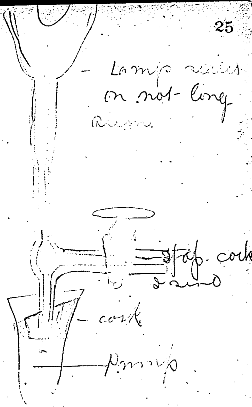
No 8 Nitric acid
Diluted X5 water
Fiber mused in acid
Leave Nitric and over
night—

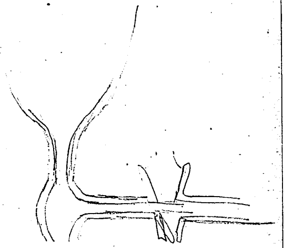
No 9 Either some
Bass soaked in ~~te~~ ether
corked in ~~test tube~~ No 9

Hydrochloric acid
and small bits of fiber
with ammonia

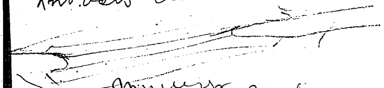
~~action violent~~

Had to leave fiber up
for depositing experiments but let the
fiber stand in the
Test tubes


Lamp
on not-long
stop. cock
cork
Pump



Started pump with lamp
at 12.30 commenced
working formed Hydrogen
under pressure 1/5 mm
on manometer mm.
hot pump clean
Rubbers clean.



Mercury seal

Manometer pressure
steady at 2 m pump
working nicely lamp OK.
constant manometer
had high vacuum
turned on Hydrogen
and oxydized slowly
and most impurities

and suddenly broke 31
tried with rubber
now by with glass
cock

Glass cock works well
but ~~the~~ final - In. No 1
was low resistance
and did not change
by running Edison test

No 2 Di. No 1 Lamp Glass
cock sumeny arms.
with a few grams
of Naphthaline in stem
leading to bulb gave
light while running

at just on account
of vacuum increasing
(supposition) I fused the
napthaline on the tube
after 15 min burning
and increased light
perceptibaly burning
about 22 candles now
judge after fusing

~~Napthaline~~ left - where
residue on ~~tube~~

Very bright and turned
4.36 (second) at about 500
candle power it broke
greatly and took it out and
examined fiber was dis-
integrated and ~~broke~~ parallel
to the fiber

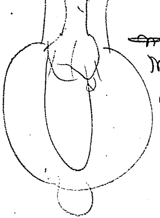
Mistake to freeze
the Naphthaline &

Trial twice second
and first are smaller
together and gave a
good result of 800 candle
power Judged by Edison

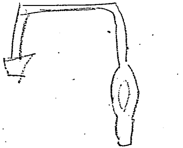
20
23
21
36

4 | 100
25

Next bend over and put ~~[illegible]~~ naphthaline inside of globe and here carbon standing



~~[illegible]~~ naph. scattered around inside globe



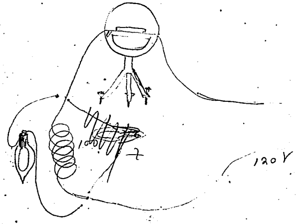
45° $40''$ $30'''$

$2\alpha\overline{)6\alpha}($
3

.45–

30° $2''.5$

29°
29°



100 19.

Second Test -

Stand. Ohms	Defl.	Ten
100	19	.34,4328 =
90	20¼	.34481
80	23	.424475

100)344328

34.43280

.0003

34.4328

.133

1

Throngs Leg
Restitore
Knam

100	27
90	29
80	35
100	28
90	30
90	30½
80	33
100	26
95	28
80	32
90	33
100	29
95	30
90	34
	33½

27
28
26
29

4 | 110
27½

27½ = 100

29
30
2

35
33
32

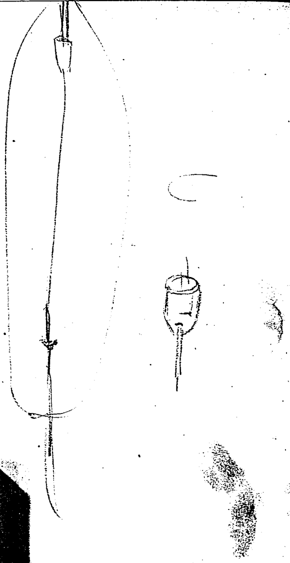
3 | 100
33½ = 80

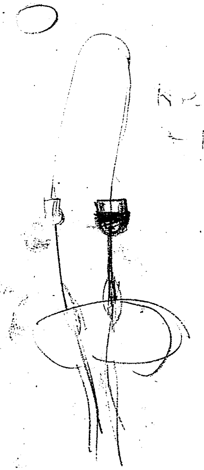
~~Com[illegible]~~

Commenced Pump at 12 M.N.

Lamp to be lit without Naphthaline at 12,55

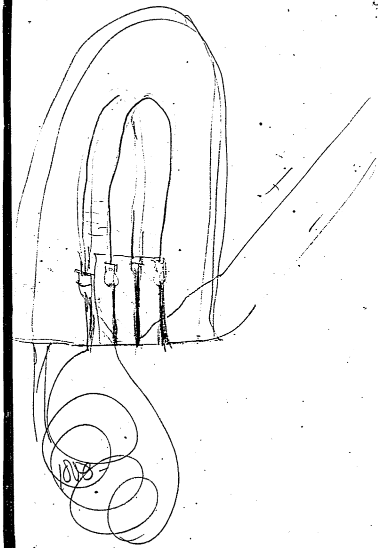
5 Min	11	Standing at 13 steady
"	14	
	15	Boiling
[illegible]	9	
[illegible]	7	Standing at 20
"	6	
No [illegible]	21	Lit Vapor in [illegible] in the Globe
		25 at high Temp
		instead of [illegible] lamp





First Experiment —

In it haa a vacuum Hydrogen tub —


1048

had a double pump one side made with large con-tration and other a small contration with small fall tube The large tube was to large for the con-ration and would not work as after three trials sealed it off and let the small contration and small fall tube worked moderately well but slow and had no arrangement for testing vacuum but think it was not high lamp was a depositor ~~lamp~~ carbon

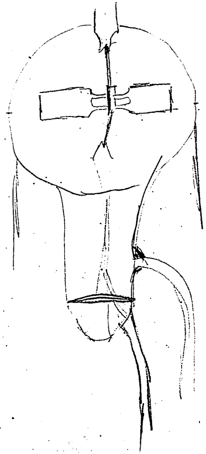
Lamp No. 1

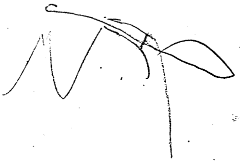
The next was a regular
pump ~~[illegible]~~ Hg. heated
to about 110° pur[?] and worked
very well given instant-
pull- ~~e~~ ~~[illegible]~~

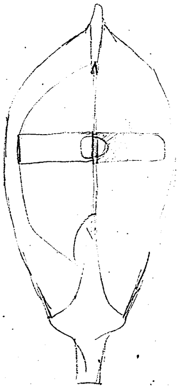
2 ~~heated~~ mercury in a
glass bottle (but bottom busted
out and lost my vacuum
had com. iron bottle
and heated mercury
by Bunsen's burner

1st lamp ~~took~~ reg. bamboo carbon
for first experiment and
exhausted to a high degree
2 in spark from large coil
would not pass in heating.
~~The last was~~ lamps they

61 Page Con.







were just heated with
very low which did not bring the ~~cement at first~~
carbon to incandescence
which presumably showed
by the spark and drops
of ~~mercury~~ Hg carried
down more air between
them gradually heated lamp
and ~~took~~ sealed
with higher vacuum in
about 4 hours tested for
economy (Page 62.) per horse
power external heat
of globe burning at
16 & ~~18~~ candles was 75° Fah
Second lamp brought up
as the first — but after

pumping till got high
vacuum ~~on~~ no blue
on clamps no deposit
on globe and ~~putting~~
light of 18/ candle power
~~P~~ Edison put magnet
to pos/ piece and ~~attracted~~
from the clamp on blue
matter which gradually
left with high vacuum
~~but~~ when cast seen seemed
to have a ~~[illegible]~~ Tendacy
for the centre of the clamp
~~that is~~ where formed a
circle ~~[illegible]~~ below ~~[illegible]~~
of clamps near the pump

about 6 hours

Lamp tried

Keeping mercury at 107

to 110° [illegible] found lamps to

be brought up high as

nos 14 2 but after using

all ~~of~~ coloration by small

horse shoe magnet and

large electro-magnet with

two batterys, applied to

pos. pole of lamp and

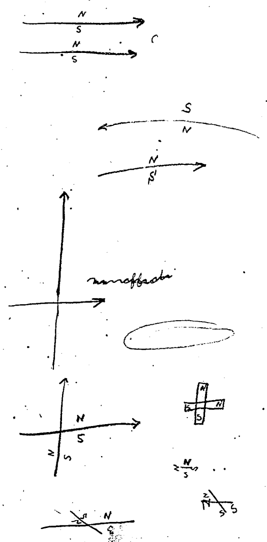
pump the [illegible]

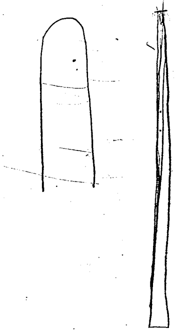
Nov. 26

~~S~~ Sand - 1½ inches
~~on~~ spark

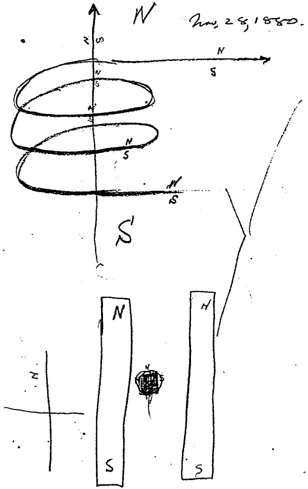
Nov 27
Commenced Pumping
on Haydi's lamp at
11.5 am. CCO pump
cleaned.

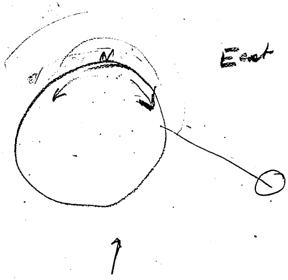
Got lamp cold might
could not pass
5 in spark 1/16.
mals on spark
gage commenced
11 stopped 4.30
5:30 time to get -
vacuum.

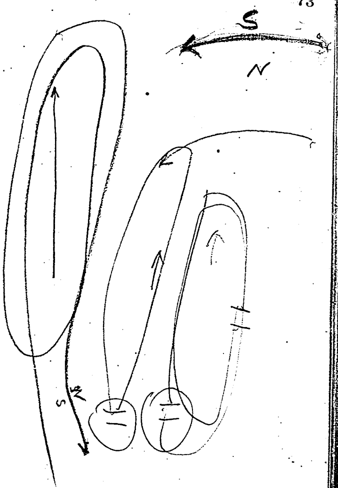

N
S
N
S
S
N
N
S
N
S

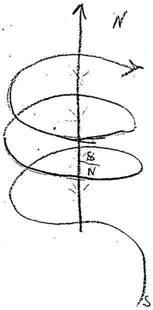


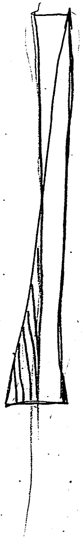
Nov 28, 1880.

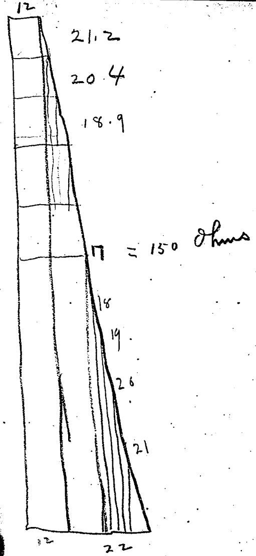



East


S
N


N
S
N
S





12 : 17 :: 150 : 212 Ohms

$$\begin{array}{r} 150 \\ 17 \\ \hline 1050 \\ 150 \\ \hline 12)\,2550\,(212 \\ 24 \\ \hline 15 \\ 12 \\ \hline 3 \end{array}$$

212 Ohms

21.2 to division

$$\begin{array}{r} 21.2 \text{ Ohms} \\ \times 2 \\ \hline 42.4 \\ 212 \\ \hline 254.4 \\ 2 \\ \hline 508.8 \text{ Ohms} \end{array}$$

$$\frac{1}{R} = \frac{1}{R'} + \frac{1}{R''} = \frac{R'+R''}{R'R''}$$

$$R = \frac{R'R''}{R'+R''}$$

$R' = 21.2$

$R'' = 509$

$R' + R'' = 530.2$ Ohms

R'

21.2
509
1996
1060
1079.06 (20.4 Ohms
530) 1079.06
1060
1906

maximum

15 : 14 :: 20.4
14
816
204
2856

15) 2856 (190
15
135
135

$R' = 20.4$

$R'' = 254.4$

~~4584~~

254.4
20.4
10176
5088
5189.76

2748) 5189 (18.9
2748
24410
16732

6) 1.0 (.017
6
40

5280
~~2640~~
1760 feet

38.7 lbs of Cu per ft
36
2322
1161
1393.2
600
835,920.0

36
7
252
14
3600

~~240~~
2800 tons of Cu
to run a 14 Ohm lamp
for 600 lights at a
distance of two miles.

18.9

16 : 15 :: 18.9
15
945
189
16) 283.5 (17.7
16
123
112
115

17 : 16 :: 17.7 ; 16.66
16
1062
177
17) 283 2 (16.66
17
113
102
112
102
10

18 : 17 :: 16.66 ;
17
11662
1666
18) 283 2 2 (~~153~~
18
103
~~98~~
~~50~~
90
130
126
4

15.67
15.73

19 : 18 :: 15.73
18
4

1.1968
1.2553
8.7212
1.1733 14.9
1.2788
20 8.6990
1.1511 14.2

1.1511
1.3010
21 8.6777
1.1298
~~1.3223~~
22 1.3223
8.6575
1.1696

12.9
13.4
14.2
14.9
15.73
16.66
17.7
19.
20.4
21.2
166.09

Ohms.

Decreasing carbon
0."012 to 0."022

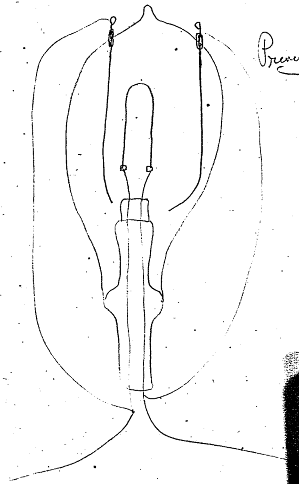
Lamp on 6-15 A.M.

First current 8-15

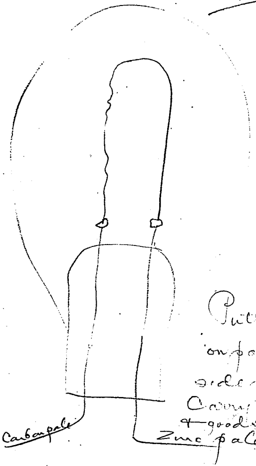
Dull red 8-40

Nov 28 1880 9 AM

Prevent Carrying

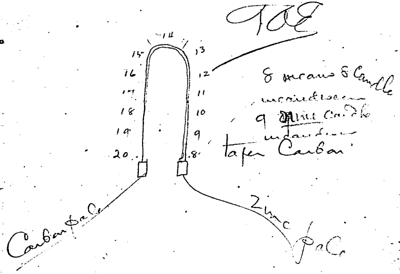


Nov 29 1880 TAE



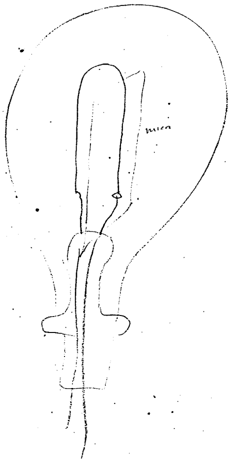
Putting bad side
on positive pole
side prevents
Carrying Blackening
& good side of Carbon
pole will burst

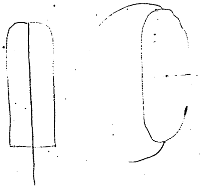
Nov 29 1880



This method Compensates for the Carrying off Carbon by Electricity as the Carrying side has lower incandescence and was the way we proposed last summer

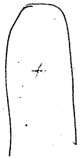
Nov 29 1880 TAE





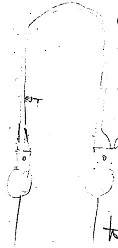
Factory
Large lamp Dec 6.

tried 4 times to produce
high vacuum with large
pump and failed, has
carbon changed and
old style pump.
work very satisfac-
Factory Dec 6
small carbon arch.
at Fig. 4 indications
of high vacuum and
had markings on
globe. another small
carbon busted by putting
on full current — being
in line air leak in lamp

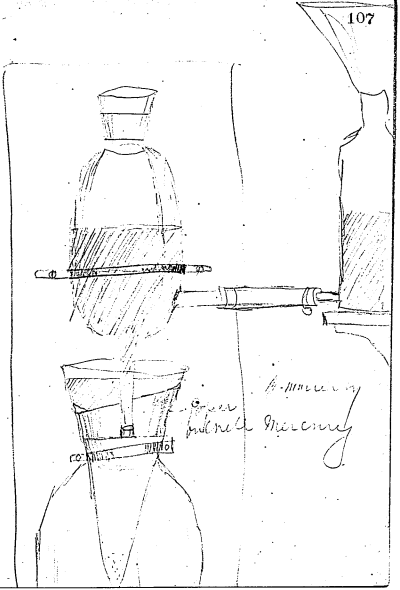


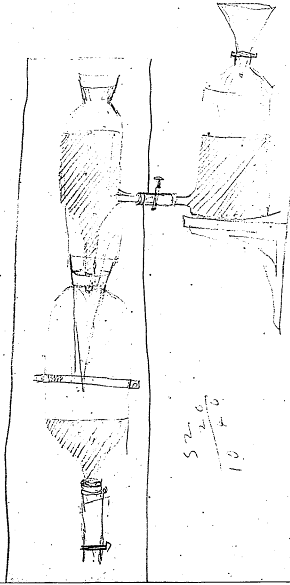
for bug. had a carbon
Bamboo $\frac{8}{1000}$ thick taper-
ing from 22/1000 to 12/1000
put near spot on +
pole the piece with blue
Also had common carbon
on but mercury jumped
on the Batchelor's pump

Dec 9, 1880



~~at~~
When burning
is repelled
1/4 in and no
change grad-
ually attracted
to carbon

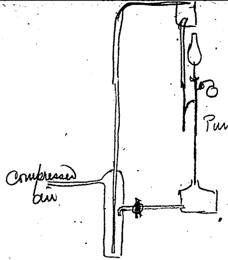

Green
Mercury



So N[illegible]
~~written~~ attempted on
these books like
the crazed

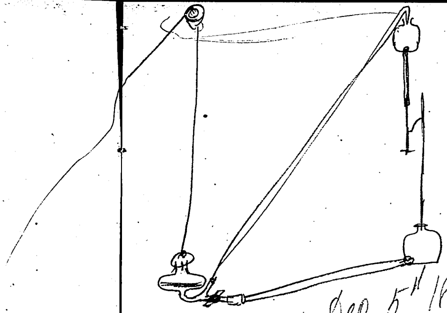
3rd.
Coat with Li. acid
Run through paper funnel
in Reg. way.
2nd
Run thing vacuum.
and [illegible] — save
1.2.3. and [illegible]
15° of air running

Dec 5th 1880



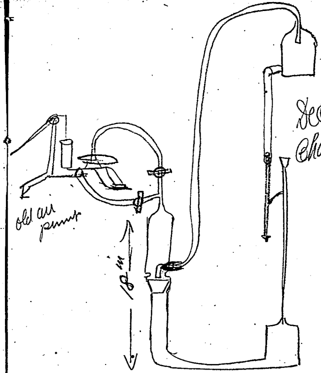
Chas Batchelor

Mercury lifting



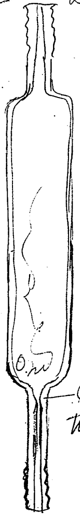
Dec 5th 1880
Chas Batchelor

Mercury raising



Dec 5th 1880
Chas Batchelor

Mercury Cleaning Dec 7 1880

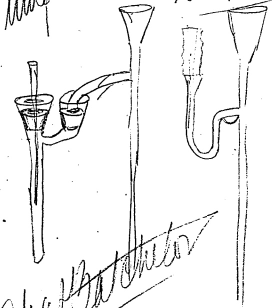


Mixt with powdered
& broken Glass

contraction about ~~1/4~~
twice diam. of ous

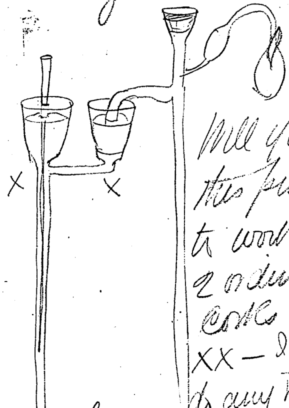
Pumps

Dec 7th 1880



Chas Batchelor

Mr Holzer Dec 6th 1880



Will you alter this pumps to work with 2 ordinary corks at XX — I cannot do any thing with these large size corks

Batchelor

12 : 128 :: 10 : x

12) 1280
107

16 : 128 :: 10 : x

128

10 : 128 : 16 : x 2048

16
768
128
2048

10 : 306 :: 16 : x
16
1836
306
18) 4896

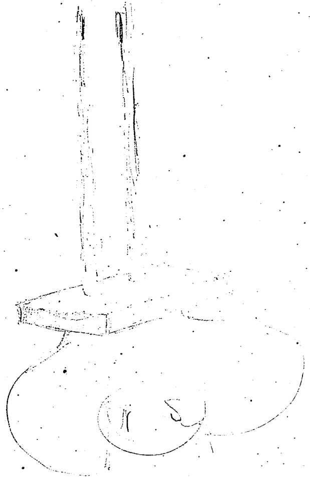
Chals:

Charles

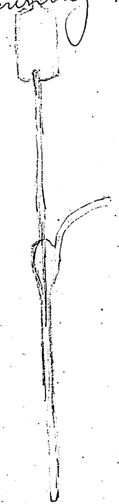
Bo

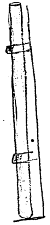
Tho. A. Edison

Tho A Edison



An engine to be worked by expansion and contraction of mercury — Theory

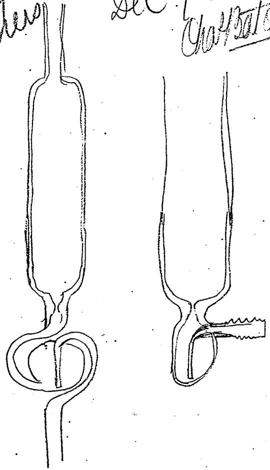




Mercury Cleaners

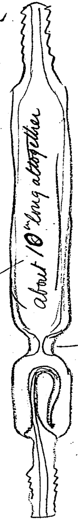
Dec 7 1880

Chas Batchelor



Dec 7 1880
Chas Batchelor

Mercury cleaner



Frank make me one just like last night's only a chamber at bottom and a siphon so that any of the pieces of glass will not go through the pump

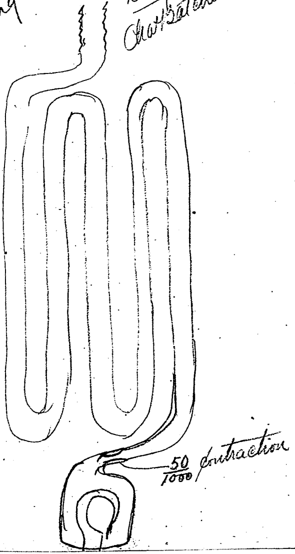
B

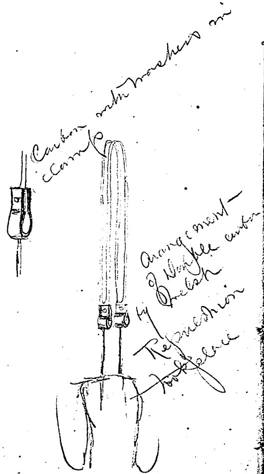
On next page also

Mercury Cleaning

Dec 7 1880

Chas Batchelor



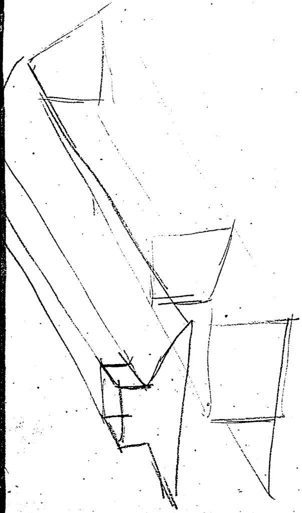


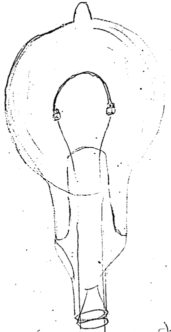
Dec 11 1880

Tried carbon with washers of large parts of old carbons

Sealed off High vacuum

Tried cloth





tried a lamp like ~~the~~ above
today Dec 13 1880 very good
results 1/4 size 5 times incandes
inside very black but sealed off
all right

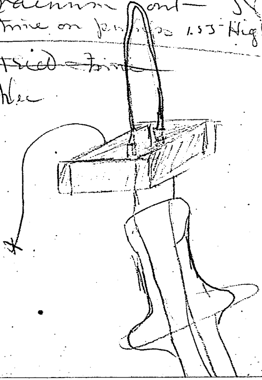
630
435
1 95
1.55

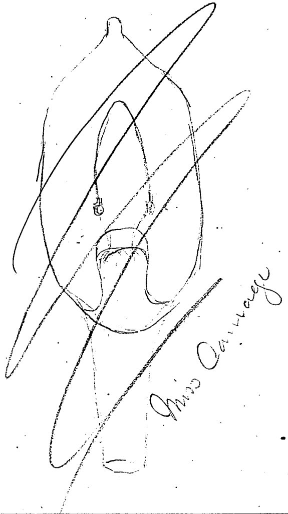
Also sealed off a lamp a ~~little~~ longer which gave about ~~the~~ same results — Now working upstairs with four pumps instead one on catching vacuum out — No 9.

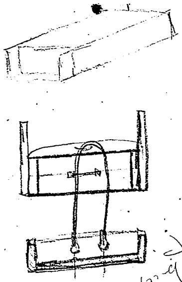
Time on pumps 1.55 High vacuum

~~Tried Tim~~

Wee




Miss Carriage



for placing the carbon
on cloud glass

1 14
2 ~~17~~ 1/2
4 3 1/2
8 1 3/4
16

29-

Edisons Lamp
75 Weber

C 3,400 ft - lbs
16 3550 "
150
man.

155 C . 33000
275 C 33000

16 / 3400 (212
32
20
16
40
32

212
50
10,600

3.4

3400 ft - lbs.

4604
2
8368
3
25104
2
50208
2
33 ~~000~~) ~~11 2 4 1 6~~
37

33 / 112 (43
99
130

Lamp D.
W
1.35 — = 5131 ft.-lbs.

Lamp A.

4.07

Lamp D
1.35 Weber = 5131 foot-lbs.
Lamp A
4.07 Weber = 5850 " "

4.07
1.35
2.72 Weber

5850
5131
719 ft.-lbs.

Lamp A.

4.07 Weber = 5850 ft-lbs

Lamp do.

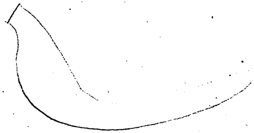
1.35 " = 5131 " "

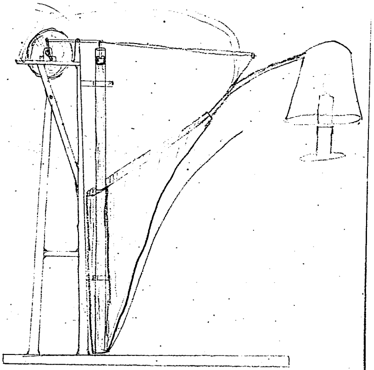
2.72 " 719 " "

1.35 : 5731 : 4.07 : x

```
    5131
    4.07
   35917
  20524
1.35)20883,17(15469
     135
      738
      675
       633   2   2
       540       1
        931
        810      4'''
        1217     3'''
        1215
           2
```

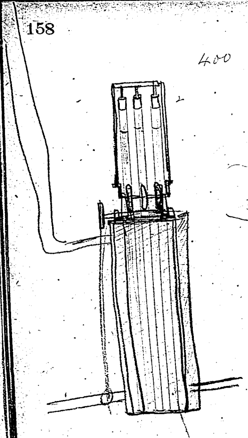
15469





400

2 89
3
6

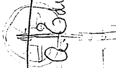


25
3
75

2400
2
4800

14.400

33000



Jno C Edison

Jno C Edison

800

6000
2

1200
4

4800

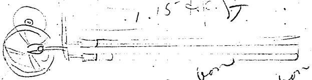
1

Street

Street

Street

1.15 HP



Good Carbon

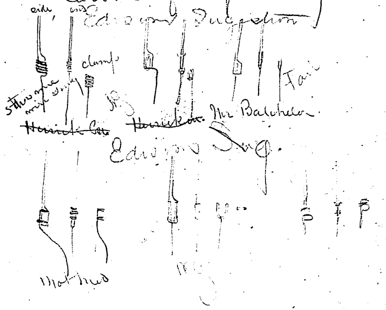
Good Carbon

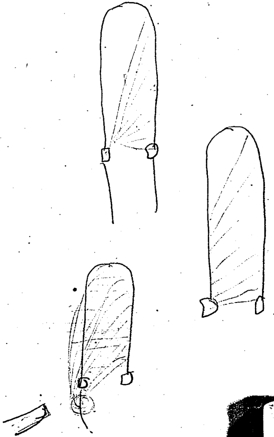
Laboratory

Lamp Factory

Dec 18. Different Ways for clamping Carbons for plating

Edison's Suggestion





Menlo Park Notebook #126 [N-80-07-21]

This notebook dates from July 1880. Most of the entries are by Edison and consist of drawings that appear to be related to the ore separator. There are also a few pages of notes, possibly by Martin Force, relating to connections in the photometer room. The label on the front cover is marked "Ore Milling" and "Martin Force." The book contains 282 numbered pages.

Blank pages not filmed: 8-279.

.25
.05
.0125

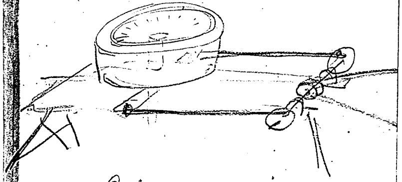
.25
5

5 : 25 :: x : 150

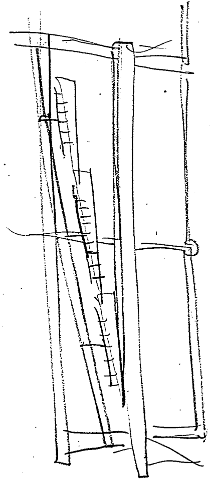
5
25) 750 (30
75

25 per cu

July 21 1880
TAE 1

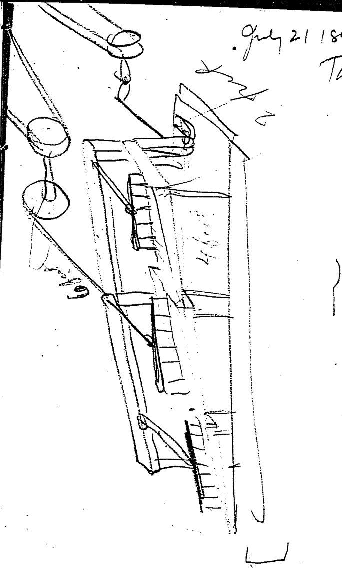


Shaking tube with
air or water



July 21 1880

TAE



Sept 13th 1880

TaE

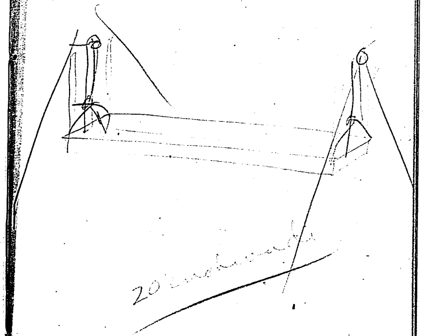


Diagram of connections from instruments to photometer room.

No 1 & 2 To resists in phot. room.
" 3 " 4 To Lamp
" 5 " 6 To Line
" 7 " 8 To rest in photometer room

33 1/3 percent

3 first

2 and

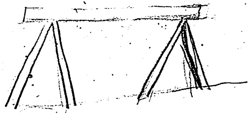
6 for

15

10

5

15



3 for One Thousand

T. A. Edison

33 1/3 Per Cent

Menlo Park Notebook #127 [N-80-00-05]

This is the first of three notebooks that contain the results of a search, conducted by Otto Moses during the summer of 1880, for literature relating to the electric light. (See also Menlo Park Notebooks #128 and #176.) The citations are listed in alphabetical order by author. There are three sets of listings, beginning on pages 1, 136, and 220. The book contains 284 numbered pages.

Blank pages not filmed: 228-284.

It is a time-honored maxim that "actions speak louder than words," and "by its fruits shall the tree be known." Let us see, then, what results this rule will bring forth if applied to those with whom we

90

From the Laboratory
of
T. A. EDISON.
MENLO PARK, N. J.
No. 127

N-(~~79-06-02~~)
80-00-05

Albert, Dominique, 2.

Alderson, Dr. James. 3.

Allen, Wm. & Wm Haseldine Pepys.

Alluaud (aîné), F. 7.

Aubergier, Hector, 2.

Aubert.

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Manch. Soc. Mem. VI., 1842 p. 399-408

On an artificial formation of plumbago [1825]
Camb. Phil. Soc. Trans. II., 1827. p. 441-443

On the quantity of carbon in carbonic acid and on the nature of the Diamond.
Phil. Trans. 1807. p. 267-292

Analysis of a carbonaceous substance found in a porcelain furnace. (see page 57.)
Annal. de Chemie IV., 1817. p. 67-70.

On the combination of Hydrogen with the metalloids.
Journ. de Pharm. XXII., 1836 p. 257-265

On the spontaneous ignition of pulverized charcoals.
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Becquerel. H.: (see Wöhler

Beetz, W. 26.

on increase conductivity Carbon by heat. Brass filings & plat. Blocks in tube &.

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Berthelot, Marcellin 3.

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Journ. des Mines. XI., 1801, p. 253-256.

On the products extracted from coal tar.

Presse Scientifique II., 1860 p. 329-330.

On the decomposition of sulphide of Carbon by Electricity.

Pog. An. XVII., 1829., 183.-184. (See Wöhler do. p. 482, 483

On electrical conduction through carbon and metallic oxides.

Poggend. Annal. CXI., 1860, p. 619-621.

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Action of a red heat on alcohol and acetic acid.

Annal. de Chem. XXXIII., 1851, p. 295-302.

On the precautions to be taken in heating bodies in closed vessels

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Berthier, P. 98.

Berthollet, A. B. 2

On the analysis of carburetted gases.
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L'Institut, XXVII., 1859, p. 364-368.

Synthesis of acetylene by the direct combination of carbon and hydrogen.
Paris. Comptes Rendus, LIV. 1862, p. 640-644.
Chem. News. V., 1862, LXXXV., 1862, 184-185.

Examination of some combustibles.
Annal. de Chemie, LIX., 1835, p. 225-263.

Analysis of bitumen from Seyssel.
Bibl. Univers. XVII., 1838, p. 183-188.

Researches on the reciprocal action of sulphur and carbon.
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Note on the memoire of Messrs. Clement + Désormes: "Experiments on Carbon" do. 121-152,
Annal. de Chemie, XLII., 1802. p. 282-288.

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Paris. Mem. de L'Institut IV., 1803. p. 269-318, 319-324, 325-333.

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Binney, Ed. Wm. 17.

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Gilbert Annal. XLIII., 1813, p. 441-444.

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Paris, Soc. Geol. Bull. VI., 1834-35, p. 11-13.

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Lyon. Soc. Agri. Annal II., 1839. 515-517.

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Annal. des Mines, V., 1829.. 211-222

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Jour. des Mines XXX., 1811. 373-376

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Annal. des Mines IV., 1819. 177-205.

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Brande. Wm. Th. 20.

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Annal. de Chemie XXXI., 1826 p. 37–53.

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Schweig. Journ. XLVI. (= Jahrb. XVI.) 1826. 475–481.

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Breithaupt, August, 39

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Brett, R. H. 4

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Thompson's Ann. Phil. XII 1x2, 1826. 192-201.

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Annal. de Chem. XLV., 1855.. 351-352.

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* On the atomic weight of Graphite.
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Liebig. Annal. XLIII., 1842... 241-251.

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Bunsen, R. W.

Bussenius and Eisenstück.

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Silliman, Journ. XXIV., 1833, 172-173.

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On some derivatives of Petroleum.
Liebig's Ann. CXIII., 1860. 151-169.

On Carbon considered as a decolorizing agent.
Quart. Journ. Sci. XIII., 1822. 257-277.

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Caignard-de la Tour, Charles. 37

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Cahours, Auguste. 3.

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Bull. de Pharm. III., 1811. 264–268.

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Comptes Rendus. XXV, 1847 - 81-82.

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——— , and J. Pelouze. 2

Callias, -

Cancrin. Graf von.

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Chevreusse, —

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Bibl. Univers. Archives, VIII., 1848.. 5-21.

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Christison, Robt. 10

Church. Archur H. 7

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Annal. de Mines XVII., 1860.. 289-299.

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Cluzel —, 2

Colquhoun, Hugh.

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Conybeare, J. J., 11

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Annal. de Chemie, XXXIV., 1812. 73-112; 113-172.

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Creighton, Wm. 11.

Crossley, Wm. 3

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put in tube ~~heated~~ Bisulphide
Carbon or Carburetted H passed
through then heated gently
to red heat, [illegible]
made a Bell [illegible]
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———, 64

———, 75

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———, 25

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Sainte-Claire Deville, H., 21

——, 37.

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——, 66.

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Sawage, —

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Schaub, J., 9.

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Schrötter, A., 15

——, 22

——, 55

Schübler, G., 17

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Schulze, F., 7

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Sefström, N. G., 10

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——, 32 b

——, 36.

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Simmonds, P. L., 6.

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Stammer, Karl, 3

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Taddei, Gioachino., 6

Tennant, –

Thompson, T., 8

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Tilley, Thomas G.,

Tordeux, A. J.

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Vanuxem, L. 9

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Violette, — 1 & 2.

——, 4

——, 5

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—, 55 & 67.

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Weber, Reinhardt., 9

Weekes, W. H., 5

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Zeise, Wm. C., 24.

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37

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